Nelson Mathematics 4

Teacher's Resource

Ontario Supplement

Series Authors and Senior Consultants
Mary Lou Kestell • Marian Small

Senior Authors
Heather Kelleher • Kathy Kubota-Zarivnij • Pat Milot • Betty Morris • Doug Super

Supplement Authors
Donna Commerford
Lynda Cowan

THOMSON NELSON

Australia Canada Mexico Singapore Spain United Kingdom United States

THOMSON
NELSON

Nelson Mathematics 4
Teacher's Resource
Ontario Supplement

Series Authors and Senior Consultants
Mary Lou Kestell, Marian Small

Senior Authors
Heather Kelleher, Kathy Kubota-Zarivnij, Pat Milot, Betty Morris, Doug Super

Student Book Authors
Carol Adam, Jennifer Brown, Carol Brydon, Anne Cirillo, Andrea Dickson, Roz Doctorow, Wendy Dowling, Catharine Gilmour, Elizabeth Grill-Donovan, Jack Hope, Wendy Klassen, Kathy Kubota-Zarivnij, David Leach, Pat Margerm, Gail May, Pat Milot, Scott Sincerbox, Marian Small, Ian Stackhouse, Mary Steele, Susan Stuart, Debbie Sturgeon, Rosita Tseng-Tam

Assessment Consultant
Damian Cooper

Supplement Authors
Donna Commerford
Lynda Cowan

Director of Publishing
Beverley Buxton

General Manager, Mathematics, Science, and Technology
Lenore Brooks

Publisher, Mathematics
Colin Garnham

Managing Editor, Development
David Spiegel

Product Manager
Linda Krepinsky

Program Manager
Lynda Cowan

Assistant Editor
Carmen Yu

Editorial Assistant
Amanda Davis

Executive Director, Content and Media Production
Renate McCloy

Director, Content and Media Production
Linh Vu

Content Production Editor
Sara-Jane Wearing

Copy Editor
Julia Cochrane

Proofreader
Christine Hobberlin

Production Manager
Cathy Deak

Senior Production Coordinator
Sharon Latta Paterson

Interior Design
Suzanne Peden, Tammy Gay

Compositor
Tammy Gay

Photo/Permissions Researcher
Vicki Gould

ISBN-13: 978-0-17-630612-9

ISBN-10: 0-17-630612-9

Printed and bound in Canada
1 2 3 4 09 08 07 06

For more information contact Nelson, 1120 Birchmount Road, Toronto, Ontario, M1K 5G4. Or you can visit our Internet site at http://www.nelson.com

Contents

Introduction

This supplement is designed to align *Nelson Mathematics 4* to the 2005 Ontario Curriculum.
Nelson Mathematics 4 is built on a sound research foundation (see *Mathematics Education: A Summary of Research, Theories, and Practice*, available at any Teacher Centre on the Nelson Mathematics Web site). The instructional design, including the integration of assessment and evaluation, is congruent with current best practices.

Organization of the Ontario Supplement for *Nelson Mathematics 4*

The Chapter Planning Charts in this supplement provide:
- expectations addressed in each lesson and Chapter Task
- teaching suggestions for adapting existing lessons
- identification of lessons that are not required for the grade expectations
- identification of lessons that are beyond the grade expectations
- references to new lessons

Following the Planning Charts are the new student lessons to address new expectations, each followed by the related teaching notes.

General Note: Parts of expectations that are inside square brackets are addressed in other lessons.

Chapter 1 Planning Chart: Patterns in Mathematics

Chapter 1 Note: For number patterns throughout Chapter 1, encourage students to include the terms *growing patterns* for patterns where the numbers increase, and *shrinking patterns* for patterns where the numbers decrease.

In Lesson 3, start using *term* to mean each number or item in a pattern, and *term number* to tell the position of a term in a pattern. For example, the pattern 3, 6, 9, 12, … starts with the terms 3, 6, 9, and 12. The term 3 can be called the first term or term number 1. Similarly, the term 6 can be called the second term or term number 2. Lead students to use this vocabulary throughout the remainder of the chapter.

Content	Expectations	Addressing Expectations
Getting Started: Sorting to Make a Pattern, pp. 2–3		Assessment Opportunity: For prompts B and D, have students make a pattern using 2 attributes, not 2 or more attributes.
Lesson 1: Patterns with Multiple Attributes, pp. 4–5		Not in Grade 4 curriculum
Lesson A: Geometry Patterns, Supplement, pp. 38–39	• describe, extend, and create a variety of [numeric and] geometric patterns, make predictions related to the patterns, [and investigate repeating patterns involving reflections] – make predictions related to repeating geometric [and numeric patterns]	New Lesson
Lesson 2: Number Patterns, pp. 6–7	• describe, extend, and create a variety of numeric [and geometric] patterns, [make predictions related to the patterns, and investigate repeating patterns involving reflections] – extend, describe, and create repeating, growing, and shrinking number patterns – create a number pattern involving addition, subtraction, [or multiplication,] given a pattern rule expressed in words	***Teaching and Learning:*** Explain that patterns that decrease can be called *shrinking* patterns and patterns that increase can be called *growing patterns*. Along with the 5 students' patterns, present the pattern 1, 3, 4, 6, 7, 9, 10, … and this description: The numbers increase by different amounts, but the amounts are repeated. Guide students to realize that the pattern is created by starting at 1, adding 2, adding 1, and then repeating the process of adding 2, then adding 1. Have students include this new pattern in their answers to prompts A and B. The answer for the new pattern in prompt A is 12, 13, 15. An answer for the new pattern in prompt B is 5, 8, 10, 13, 15, 18, 20, … The description is start at 5, add 3, add 2, and then repeat these additions. ***Consolidation:*** Include a question similar to Question 4, but change the word *increases* in part a) to *decreases*, asking for a pattern that decreases by a different amount each time.
Lesson 3: Patterns in T-Charts, pp. 8–9	• describe, extend, and create a variety of numeric [and geometric] patterns, make predictions related to the patterns, [and investigate repeating patterns involving reflections] – extend, describe, and create [repeating,] growing, [and shrinking] number patterns – connect each term in a growing [or shrinking] pattern with its term number, and record the patterns in a table of values that shows the term number and the term – make predictions related to [repeating geometric and] numeric patterns	***Teaching and Learning:*** Introduce the vocabulary *term* and *term number*, which are defined in Lesson 1B: *term*: Each number or item in a pattern *term number*: A number that tells the position of a term in a pattern Discuss that in Manitok's t-chart, the total number of green blocks is the term. Explain that the term number tells the position of the term. In Manitok's t-chart, the term numbers are the same as the numbers of inukshuit since the number of inukshuit starts with 1 and increases by 1. Help students include the words *term number* and *term* in their t-charts. ***Consolidation:*** Ask students to identify the terms and the term numbers in Questions 3 and 4. Have students include a column for the term numbers and add the word *term* to the appropriate column. Term number | Inukshuk | Term, total number of green blocks 1 | 1 | 3 2 | 2 | 6 For Question 5c), ask, "How did you predict the answer?" Encourage discussion about various strategies for predicting.

<table>
<tr><th>Content</th><th>Expectations</th><th>Addressing Expectations</th></tr>
<tr><td>Lesson 4: Measurement Patterns, pp. 10–11</td><td>• describe, extend, and create a variety of numeric [and geometric] patterns, make predictions related to the patterns, [and investigate repeating patterns involving reflections]
– extend, describe, and create [repeating], growing, [and shrinking] number patterns
– connect each term in a growing [or shrinking] pattern with its term number, and record the patterns in a table of values that shows the term number and the term
– create a number pattern involving addition, subtraction, [or multiplication,] given a pattern rule expressed in words
– make predictions related to [repeating geometric and] numeric patterns</td><td>Teaching and Learning: Discuss that the total numbers of school days are the terms in the pattern: 195, 390. Use this chart to emphasize that the term number identifies the position of the term, so 195 is the 1st term or term number 1 and 390 is the 2nd term or term number 2. Ensure that students understand that the term number is not the grade.
Help students include the words term number and term in their t-charts.
<table><tr><th>Term number</th><th>Grade</th><th>Term, total number of school days</th></tr><tr><td>1</td><td>K</td><td>195</td></tr><tr><td>2</td><td>1</td><td>390</td></tr></table>Refer to prompt A, and discuss how to create the pattern when told the pattern rule.
Make sure that students realize that Question 2 asks about the column for the total number of school days.
Consolidation: Have students include a column for the term numbers and add the word term to the appropriate column for Questions 3, 4, and 7. Elicit from students that in Question 3, term number 1 is 19 and term number 2 is 38, not the grade. In Question 4, the number of days and the number of years happen to be the same as the term numbers.</td></tr>
<tr><td>Lesson B: Decreasing Patterns, Supplement, p. 41</td><td>• describe, extend, and create a variety of numeric [and geometric] patterns, make predictions related to the patterns, [and investigate repeating patterns involving reflections]
– extend, describe, and create [repeating, growing, and] shrinking number patterns
– connect each term in a [growing or] shrinking pattern with its term number, and record the patterns in a table of values that shows the term number and the term
– create a number pattern involving [addition,] subtraction, [or multiplication,] given a pattern rule expressed in words
– make predictions related to [repeating geometric and] numeric patterns</td><td>New Lesson</td></tr>
<tr><td>Mid-Chapter Review: p. 12</td><td></td><td>Assessment Opportunity</td></tr>
<tr><td>Math Game: Calculator Patterns, p. 13</td><td></td><td>Optional</td></tr>
<tr><td>Lesson 5: Solve Problems Using a Patterning Strategy, pp. 14–15</td><td>• describe, extend, and create a variety of numeric [and geometric] patterns, [make predictions related to the patterns, and investigate repeating patterns involving reflections]
– extend, describe, and create repeating, growing, and shrinking number patterns
– create a number pattern involving addition, [subtraction, or multiplication,] given a pattern rule expressed in words
– make predictions related to repeating [geometric and] numeric patterns</td><td>Teaching and Learning: After discussing Miki's Solution, say, "Suppose there were 200 clowns. What predictions could you make about the clowns? How can you check your predictions?"
Consolidation: For Question 7, remind students that the pattern can be repeating, growing, or shrinking and that the solution can require extending a pattern or predicting terms. Arrange for students to share their problems, compare solutions, and discuss patterns.</td></tr>
<tr><td>Lesson 6: Multiple Number Patterns, pp. 16–17</td><td>• describe, extend, and create a variety of numeric [and geometric] patterns, make predictions related to the patterns, [and investigate repeating patterns involving reflections]
– extend, describe, and create repeating, growing, [and shrinking] number patterns
– create a number pattern involving addition, [subtraction, or multiplication], given a pattern rule expressed in words
– connect each term in a growing [or shrinking] pattern with its term number, [and record the patterns in a table of values that shows the term number and the term]
– make predictions related to repeating [geometric and] numeric patterns</td><td>Teaching and Learning: Remind students to use the words term and term number.
Consolidation: Include a question that requires students to create an addition pattern when they are given the pattern rule. For example:
Start at 1 and add 3 to each term to get the next term.
(1, 4, 7, 10, 13, …)
Start at 2, add 2 to get the 2nd term, add 1 to get the 3rd term, add 2 to get the 4th term, add 1 to get the 5th term, add 2 to get the 6th term, add 1 to get the 7th term, and so on.
(2, 4, 5, 7, 8, 10, 11, …)</td></tr>
<tr><td>Lesson 7: Finding Missing Terms, pp. 18–19</td><td>• describe, extend, and create a variety of numeric [and geometric] patterns, make predictions related to the patterns, [and investigate repeating patterns involving reflections]
• demonstrate an understanding of equality between pairs of expressions, using addition, subtraction, [and multiplication]
– extend, describe, and create [repeating,] growing, and shrinking number patterns
– make predictions related to [repeating geometric and] numeric patterns</td><td></td></tr>
</table>

Content	Expectations	Addressing Expectations
Lesson 8: Equivalent Equations, p. 20	• describe, extend, and create a variety of numeric [and geometric] patterns, make predictions related to the patterns, [and investigate repeating patterns involving reflections] • demonstrate an understanding of equality between pairs of expressions, using addition, subtraction, [and multiplication] – extend, describe, and create [repeating], growing, and shrinking number patterns – make predictions related to [repeating geometric and] numeric patterns	
Mental Math: Adding with 5s, p. 21		Optional
Curious Math: Pascal's Triangle, p. 21		Optional
Skills Bank: pp. 22–23		Optional: Question 1 can be assigned since it is related to Getting Started and to Lesson 2A.
Problem Bank: p. 24 **Chapter Review:** p. 25		Optional Assessment Opportunity: Question 1 can be assigned since it is related to Lesson 2A.
Chapter Review: Supplement, p. 43		New Assessment Opportunity
Chapter Task: Finding Number Patterns in Shape Patterns, p. 26	• describe, extend, and create a variety of numeric and geometric patterns, [make predictions related to the patterns, and investigate repeating patterns involving reflections] – extend, describe, and create repeating, growing, and shrinking number patterns – connect each term in a growing or shrinking pattern with its term number, and record the patterns in a table of values that shows the term number and the term – create a number pattern involving addition, subtraction, [or multiplication, given a pattern rule expressed in words]	Assessment Opportunity: Encourage students to use the vocabulary *term* and *term number* during discussion. For prompt E, students might create a repeating, growing, or shrinking pattern.

Chapter 2 Planning Chart: Numeration

Content	Expectations	Addressing Expectations
Getting Started: Modelling Numbers, pp. 28–29		Assessment Opportunity
Lesson 1: Place Value, pp. 30–31	• read, represent, [compare, and order] whole numbers to 10 000, [decimal numbers to tenths, and simple fractions, and represent money amounts to $100] – represent, [compare, and order] whole numbers to 10 000, using a variety of tools – demonstrate an understanding of place value in whole numbers [and decimal numbers from 0.1] to 10 000, using a variety of tools and strategies – solve problems that arise from real-life situations and that relate to the magnitude of whole numbers up to 10 000	
Lesson 2: Expanded Form, pp. 32–33	• read, represent, [compare, and order] whole numbers to 10 000, [decimal numbers to tenths, and simple fractions, and represent money amounts to $100] – represent, [compare, and order] whole numbers to 10 000, using a variety of tools – demonstrate an understanding of place value in whole numbers [and decimal numbers from 0.1] to 10 000, using a variety of tools and strategies – read and print in words whole numbers to one thousand, using meaningful contexts – solve problems that arise from real-life situations and that relate to the magnitude of whole numbers up to 10 000	***Teaching and Learning:*** Since reading and printing in words for whole numbers is only required to one thousand, discuss reading 562, instead of 3562, in words as five hundred sixty-two. ***Consolidation:*** Use Question 4a), b), d), or have students write 281, not 1281, in words for part c). Use Questions 5–6.
Lesson 3: Comparing and Ordering Numbers, pp. 34–35	• read, represent, compare, and order whole numbers to 10 000, [decimal numbers to tenths, and simple fractions, and represent money amounts to $100] – represent, compare, and order whole numbers to 10 000, using a variety of tools – demonstrate an understanding of place value in whole numbers [and decimal numbers from 0.1] to 10 000, using a variety of tools and strategies – solve problems that arise from real-life situations and that relate to the magnitude of whole numbers up to 10 000	
Lesson 4: Exploring 10 000, p. 36	• read, represent, [compare, and order] whole numbers to 10 000, [decimal numbers to tenths, and simple fractions, and represent money amounts to $100] – represent, [compare, and order] whole numbers to 10 000, using a variety of tools – demonstrate an understanding of place value in whole numbers [and decimal numbers from 0.1] to 10 000, using a variety of tools and strategies • describe, extend, and create a variety of numeric [and geometric] patterns, [make predictions related to the patterns, and investigate repeating patterns involving reflections] – extend, describe, and create [repeating,] growing, [and shrinking] number patterns – create a number pattern involving addition, [subtraction, or multiplication,] given a pattern rule expressed in words – make predictions related to [repeating geometric and] numeric patterns	
Mental Math: Adding Tens, Hundreds, and Thousands, p. 37		Optional
Lesson 5: Multiplying by 10, 100, and 1000, pp. 38–39	• solve problems involving the [addition, subtraction,] multiplication, [and division] of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts, using a variety of strategies] – multiply whole numbers by 10, 100, and 1000, [and divide whole numbers by 10 and 100,] using mental strategies	
Lesson A: Dividing by 10 and 100, Supplement, p. 45	• solve problems involving the [addition, subtraction, multiplication, and] division of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts, using a variety of strategies] – [multiply whole numbers by 10, 100, and 1000, and] divide whole numbers by 10 and 100, using mental strategies	New Lesson
Mid-Chapter Review: p. 40		Assessment Opportunity: Use Questions 1–4, 6–9.
Math Game: Getting to 10 000, p. 41		Optional

Content	Expectations	Addressing Expectations
Lesson 6: Rounding to the Nearest 10, 100, or 1000, pp. 42–43	• read, represent, [compare, and order] whole numbers to 10 000, [decimal numbers to tenths, and simple fractions, and represent money amounts to $100] – demonstrate an understanding of place value in whole numbers [and decimal numbers from 0.1] to 10 000, using a variety of tools and strategies – round four-digit whole numbers to the nearest ten, hundred, and thousand, in problems arising from real-life situations – solve problems that arise from real-life situations and that relate to the magnitude of whole numbers up to 10 000	
Lesson 7: Communicate About Ordering Numbers, pp. 44–45	• read, represent, compare, and order whole numbers to 10 000, [decimal numbers to tenths, and simple fractions, and represent money amounts to $100] – represent, compare, and order whole numbers to 10 000, using a variety of tools – demonstrate an understanding of place value in whole numbers [and decimal numbers from 0.1] to 10 000, using a variety of tools and strategies – solve problems that arise from real-life situations and that relate to the magnitude of whole numbers up to 10 000	
Lesson 8: Counting Money Collections, pp. 46–47	• [read, represent, compare, and order whole numbers to 10 000, decimal numbers to tenths, and simple fractions, and] represent money amounts to $100 – read and represent money amounts to $100	***Teaching and Learning:*** Amounts of money on pp. 46–47 of the Student Book go to $50, but amounts to $100 are required. Include Day 5 with an amount such as 3 twenty-dollar bills, 1 ten-dollar bill, 3 toonies, 2 loonies, 3 quarters, 4 pennies ($78.79). Although estimating is not required, it helps students gain an understanding of representing amounts of money. ***Consolidation:*** For Question 5, include an amount greater than $50, for example, d) 2 twenty-dollar bills, 3 ten-dollar bills, 4 toonies, 3 loonies, 5 dimes, 3 nickels ($81.65).
Skills Bank: pp. 48–50		Optional: Use Questions 1, 5, 6b), c), d), 7–20.
Problem Bank: p. 51		Optional
Chapter Review: pp. 52–53		Assessment Opportunity: Use Questions 1, 2a), b), 4–17.
Chapter Task: Creating a Puzzle, p. 54	• read, represent, compare, and order whole numbers to 10 000, [decimal numbers to tenths, and simple fractions, and represent money amounts to $100] – represent, compare, and order whole numbers to 10 000, using a variety of tools – demonstrate an understanding of place value in whole numbers [and decimal numbers from 0.1] to 10 000, using a variety of tools and strategies – round four-digit whole numbers to the nearest ten, hundred, and thousand, in problems arising from real-life situations – solve problems that arise from real-life situations and that relate to the magnitude of whole numbers up to 10 000	Assessment Opportunity

Chapter 3 Planning Chart: Data Management

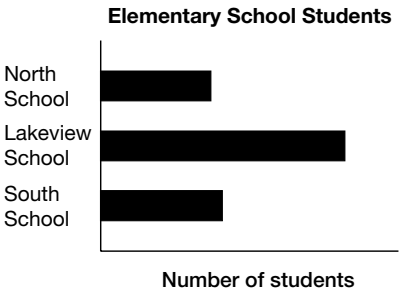
Content	Expectations	Addressing Expectations
Getting Started: Graphing Treasures of the Sea, pp. 56–57		Assessment Opportunity
Lesson 1: Constructing a Pictograph, pp. 58–60	• [collect and] organize discrete [primary] data and display the data using [charts and] graphs, [including stem-and-leaf plots and double bar graphs] • read, describe, and interpret [primary data and] secondary data presented in charts and graphs, [including stem-and-leaf plots and double bar graphs] – [collect and] organize discrete [primary] data and display the data in [charts, tables, and] graphs [(including stem-and-leaf plots and double bar graphs)] that have appropriate titles, labels, and scales that suit the range and distribution of the data, using a variety of tools – read, interpret, and draw conclusions [from primary data and] from secondary data, presented in charts, tables, and graphs [(including stem-and-leaf plots and double bar graphs)] – describe the shape of a set of data across its range of values, using charts, [tables,] and graphs	***Teaching and Learning:*** After students complete their graphs for prompt C, pose questions that lead students to describe the shape of the data as displayed in charts and pictographs. **Sample Discourse** "What does the longest row of symbols represent?" *The number of people who like Tyrannosaurus rex best.* "How would you describe the shape of the data in the graph?" T*he longest row of symbols is at the top. The shortest is at the bottom. The lengths of the other rows zigzag.* "What can you say about the shape of the data in Pedro's chart?" *All the numbers have 2 digits.* "Do you think the lengths of rows of symbols are close? Why or why not?" "Suppose you changed the order of the dinosaurs in the graph. How would this change the shape of the data in the graph?" *The symbols would show the same data, but the order of longest rows of symbols would be different.* ***Consolidation:*** Ask students what they notice about the shape of the data in their graphs. For Question 5e), ask whether students think using a different scale changes the shape of the graph. Encourage discussion about various opinions.
Mental Imagery: Dot-Paper Diagrams, p. 61		Optional
Lesson 2: Choosing a Scale for a Bar Graph, pp. 62–63	• collect and organize discrete primary data and display the data using charts and graphs, [including stem-and-leaf plots and double bar graphs] • read, describe, and interpret primary data and secondary data presented in charts and graphs, [including stem-and-leaf plots and double bar graphs] • [predict the results of a simple probability experiment, then] conduct the experiment [and compare the prediction to the results] – collect data by conducting [a survey or] an experiment to do with themselves, their environment, [issues in their school or the community, or content from another subject,] and record observations [or measurements] – collect and organize discrete primary data and display the data in charts, tables, and graphs [(including stem-and-leaf plots and double bar graphs)] that have appropriate titles, labels, and scales that suit the range and distribution of the data, using a variety of tools – read, interpret, and draw conclusions from primary data and from secondary data, presented in charts, tables, and graphs (including stem-and-leaf plots and double bar graphs) – describe the shape of a set of data across its range of values, using charts, [tables,] and graphs – [predict the frequency of an outcome in a simple probability experiment, explaining their reasoning;] conduct the experiment; [and compare the result with the prediction]	***Teaching and Learning:*** Ask questions about the shape of Mandy's graph and about the graphs drawn for prompts C and E. **Sample Discourse** "What can you say about the shape of Mandy's graph?" *The bars are close to the same length. The top bar is shorter.* "Suppose Mandy made her graph with the bar for 'no 5s' at the top. Would this change the shape of the graph?" *The bars would still be close to the same length, but the top bar would be longer.* "How does the shape of the graph for your experiment compare with the shape of Mandy's graph?" "How does the shape of the graph for the class results compare with the graph for your experiment?" "What does the shape of the class graph show about the shape of the data in the class chart?" *The result with a greater number in the chart is represented with a longer bar in the graph.* ***Consolidation:*** Lead students to discuss the shapes of the data in their graphs and charts.

Content	Expectations	Addressing Expectations
Lesson 3: Collecting Data, p. 64	• collect and organize discrete primary data and display the data using charts [and graphs, including stem-and-leaf plots and double bar graphs] • read, describe, and interpret primary data [and secondary data] presented in charts [and graphs, including stem-and-leaf plots and double bar graphs] • predict the results of a simple probability experiment, then conduct the experiment and compare the prediction to the results – collect data by conducting [a survey or] an experiment to do with themselves, [their environment, issues in their school or the community, or content from another subject,] and record observations [or measurements] • collect and organize discrete primary data and display the data in charts, [tables, and graphs (including stem-and-leaf plots and double bar graphs)] that have appropriate titles, labels, [and scales that suit the range and distribution of the data, using a variety of tools] – read, interpret, and draw conclusions from primary data [and from secondary data,] presented in charts, [tables, and graphs (including stem-and-leaf plots and double bar graphs)] – describe the shape of a set of data across its range of values, using charts, [tables, and graphs] – predict the frequency of an outcome in a simple probability experiment, [explaining their reasoning;] conduct the experiment; and compare the result with the prediction	Use prompts A to E, and this Reflecting question. 1. Use the word "range" in a description of the numbers of paper clips in the chart from prompt D. **Sample Response** 1. *The range is much larger than it would be without the numbers of paper clips a few really fast students linked together.* 2. *The range is small because everyone linked about the same number of paper clips.* **Note:** Have pairs keep their data from prompts B and C for Curious Math: Stem-and-Leaf Plots, and Lesson 3A.
Curious Math: Stem-and-Leaf Plots, p. 65	• [collect and] organize discrete primary data and display the data using charts and graphs, including stem-and-leaf plots [and double bar graphs] • read, describe, and interpret primary data and secondary data presented in charts and graphs, including stem-and-leaf plots [and double bar graphs] – [collect and] organize discrete primary data and display the data in [charts, tables, and] graphs (including stem-and-leaf plots [and double bar graphs]) that have appropriate titles, labels, and scales that suit the range and distribution of the data, using a variety of tools – read, interpret, and draw conclusions from primary data [and from secondary data], presented in charts, [tables,] and graphs (including stem-and-leaf plots [and double bar graphs]) – describe the shape of a set of data across its range of values, using [charts, tables, and] graphs	As students create their stem-and-leaf plots, suggest strategies they may find helpful, such as making a rough copy with the leaves in the order of the data, and using the rough copy to make a stem-and-leaf plot with the leaves in order from least to greatest. Emphasize lining up the leaves one under the other so that the lengths of the leaves show the number of leaves. Point out that there are no commas between the leaves. Since this Curious Math deals with required expectations, include these Reflecting questions. 1. How does a stem-and-leaf plot look like a bar graph or a pictograph? 2. What are advantages of stem-and-leaf plots instead of other graphs you have used? 3. What are advantages of other graphs you have used instead of stem-and-leaf plots? **Sample Responses** 1. *If each leaf in a stem-and-leaf plot is replaced by a symbol, the stem-and-leaf plot would look like a pictograph. If a bar is drawn the same length as the leaves for each stem, the stem-and-leaf plot would look like a bar graph.* 2. *Stem-and-leaf plots list the numbers. Sometimes you can't tell the exact number for sure from a graph.* 3. *Graphs give a picture of data that is easier for me to see at a glance.*
Lesson 4: Constructing a Bar Graph with Intervals, pp. 66–67		Beyond Grade 4 curriculum
Lesson A: Comparing Stem-and-Leaf Plots, Supplement, pp. 47–48	• collect and organize discrete primary data and display the data using charts and graphs, including stem-and-leaf plots [and double bar graphs] • read, describe, and interpret primary data and secondary data presented in charts and graphs, including stem-and-leaf plots [and double bar graphs] – collect data by conducting [a survey or] an experiment to do with themselves, [their environment, issues in their school or the community, or content from another subject,] and record observations [or measurements] – collect and organize discrete primary data and display the data in charts, [tables,] and graphs (including stem-and-leaf plots [and double bar graphs]) that have appropriate titles, labels, and scales that suit the range and distribution of the data, using a variety of tools – read, interpret, and draw conclusions from primary data and from secondary data, presented in charts, [tables,] and graphs (including stem-and-leaf plots [and double bar graphs]) – describe the shape of a set of data across its range of values, using charts, [tables,] and graphs – compare similarities and differences between two related sets of data, using a variety of strategies	New Lesson

Content	Expectations	Addressing Expectations
Lesson B: Constructing a Double Bar Graph, Supplement, pp. 50–51	• [collect and] organize discrete primary data and display the data using [charts and] graphs, including [stem-and-leaf plots and] double bar graphs • read, describe, and interpret primary data and secondary data presented in charts and graphs, including [stem-and-leaf plots and] double bar graphs – [collect and] organize discrete primary data and display the data in charts, [tables,] and graphs (including [stem-and-leaf plots and] double bar graphs) that have appropriate titles, labels, and scales that suit the range and distribution of the data, using a variety of tools – read, interpret, and draw conclusions from primary data and from secondary data, presented in charts, tables, and graphs (including [stem-and-leaf plots and] double bar graphs) – describe the shape of a set of data across its range of values, using charts, [tables,] and graphs – compare similarities and differences between two related sets of data, using a variety of strategies	New Lesson
Lesson 5: Reading and Interpreting Graphs, pp. 68–69	• read, describe, and interpret [primary data and] secondary data presented in charts and graphs, [including stem-and-leaf plots and double bar graphs] – read, interpret, and draw conclusions from [primary data and from] secondary data, presented in charts, tables, and graphs [(including stem-and-leaf plots and double bar graphs)]	**Teaching and Learning:** Discuss only Manitok's chart, the bar graph, and the pictograph. Circle graphs are not addressed for the Grade 4 curriculum. Use Questions 1, 2 (without reference to the circle graph on p. 68), 3, 5.
Mid-Chapter Review: p. 70		Assessment Opportunity: Use Questions 1–2.
Lesson 6: Graphing with Technology, p. 71	• collect and organize discrete primary data and display the data using charts and graphs, including [stem-and-leaf plots and] double bar graphs • read, describe, and interpret primary data and secondary data presented in charts and graphs, including [stem-and-leaf plots and] double bar graphs • predict the results of a simple probability experiment, then conduct the experiment and compare the prediction to the results – collect data by conducting [a survey or] an experiment to do with [themselves,] their environment, [issues in their school or the community, or content from another subject,] and record observations [or measurements] – collect and organize discrete primary data and display the data in charts, [tables,] and graphs (including [stem-and-leaf plots and] double bar graphs) that have appropriate titles, labels, and scales that suit the range and distribution of the data, using a variety of tools – read, interpret, and draw conclusions from primary data and from secondary data, presented in charts, [tables,] and graphs (including [stem-and-leaf plots and] double bar graphs) – describe the shape of a set of data across its range of values, using charts, tables, and graphs – compare similarities and differences between two related sets of data, using a variety of strategies – predict the frequency of an outcome in a simple probability experiment, [explaining their reasoning;] conduct the experiment; and compare the result with the prediction – determine, through investigation, how the number of repetitions of a probability experiment can affect the conclusions drawn	Use prompts A–D, Question 1. **Teaching and Learning:** When discussing prompt C, guide students to consider discussing the shape of the data in the graph, and to compare it with the shape of the data in the spreadsheet and with the shapes of the data in graphs created by other pairs. **Sample Discourse** "What do you notice about the shape of the data in this graph?" *The lengths of the bars go up and down.* *I tried listing the data in the spreadsheet from least to greatest. Now the bars go from shortest to longest.* "How does the shape of the data in this graph compare with the shape of the data in that graph?" *The shape is different because each box has a different number of each colour.* *The data are not spread out evenly.* After prompt D, help students combine data to create a double bar graph. Have each pair work with another pair to record the data for one pair in column B of a spreadsheet and the data for the other pair in column C. Ask, "What does the shape of this double bar graph show about how the data for one pair are the same as the data for the other pair? What does it show about how the data are different? How is your spreadsheet for a double bar graph different from your spreadsheet for your graphs for prompts C and D?"
Lesson C: Median and Mode, Supplement, pp. 53–54	• read, describe, and interpret [primary data and] secondary data presented in charts [and graphs,] including stem-and-leaf plots [and double bar graphs] – read, interpret, and draw conclusions [from primary data and] from secondary data, presented in charts, [tables,] and graphs (including stem-and-leaf plots [and double bar graphs]) – demonstrate, through investigation, an understanding of median, and determine the median of a set of data – describe the shape of a set of data across its range of values, using charts, [tables,] and graphs – compare similarities and differences between two related sets of data, using a variety of strategies	New Lesson
Lesson 7: Communicate About Collecting Data, pp. 72–73	• [collect and] organize discrete primary data and display the data using charts [and graphs, including stem-and-leaf plots and double bar graphs] – [collect data by] conducting a survey [or an experiment] to do with themselves, their environment, issues in their school or the community, or content from another subject, [and record observations or measurements]	

Content	Expectations	Addressing Expectations
Lesson 8: Conducting a Survey, p. 74	• collect and organize discrete primary data and display the data using charts and graphs, including [stem-and-leaf plots and] double bar graphs • read, describe, and interpret primary data [and secondary data] presented in charts and graphs, including [stem-and-leaf plots and] double bar graphs – collect data by conducting a survey [or an experiment] to do with themselves, their environment, issues in their school or the community, or content from another subject, and record observations [or measurements] – collect and organize discrete primary data and display the data in charts, tables, and graphs (including [stem-and-leaf plots and] double bar graphs) that have appropriate titles, labels, and scales that suit the range and distribution of the data, using a variety of tools – read, interpret, and draw conclusions from primary data [and from secondary data], presented in charts, tables, and graphs (including [stem-and-leaf plots and] double bar graphs) – describe the shape of a set of data across its range of values, using charts, tables, and graphs – compare similarities and differences between two related sets of data, using a variety of strategies	**Teaching and Learning:** As students make their plans about collecting the data for prompt A, you might arrange for each group to work with a partner group to complete prompts A and B creating the same survey question. Then have the groups continue for prompts C and D separately. For prompt E, the groups combine data with their partner groups to create a double bar graph, with one set of bars representing the data from one group and the other set of bars representing the data from another group. Pose questions about double bar graphs. **Sample Discourse** "What does the double bar graph show about the data that a single bar graph would not show?" "What do the double bars show about how the data for the two groups are the same? What do they show about how the data for the two groups are different?"
Math Game: Race to the Top, p. 75		Optional: The game is related to Lesson 4, which is omitted. However, students could use their math skills to play the game without having completed Lesson 4.
Skills Bank: pp. 76–77		Optional: Select from Questions 1–2, 3a), b), 6a), 7.
Problem Bank: pp. 78–79		Optional: Select from Questions 1–3, 6.
Chapter Review: pp. 80–81		Assessment Opportunity: Use Questions 1–2, 4–5.
Chapter Review: Supplement, p. 56		New Assessment Opportunity
Chapter Task: Planning a Playground, p. 82	• [collect and] organize discrete [primary] data and display the data using charts and graphs, [including stem-and-leaf plots and double bar graphs] • read, describe, and interpret [primary data and] secondary data presented in charts and graphs, [including stem-and-leaf plots and double bar graphs] – [collect and] organize discrete [primary] data and display the data in charts, [tables,] and graphs [(including stem-and-leaf plots and double bar graphs)] that have appropriate titles, labels, and scales that suit the range and distribution of the data, using a variety of tools – read, interpret, and draw conclusions from [primary data and] from secondary data, presented in charts, [tables,] and graphs [(including stem-and-leaf plots and double bar graphs)] – describe the shape of a set of data across its range of values, using charts, [tables,] and graphs	Assessment Opportunity
Chapters 1–3 Cumulative Review: pp. 83–84		Assessment Opportunity: Use Questions 1–4, 7–8.

Chapter 4 Planning Chart: Addition and Subtraction

Content	Expectations	Addressing Expectations
Getting Started: Counting Students, pp. 86–87		Assessment Opportunity: Since circle graphs are not required for the Grade 3 or 4 curriculum, use the photograph on p. 86 to introduce the following bar graph and questions that replace prompts A–C in the Student Book.  The bar graph shows the numbers of students who go to 3 different schools. South School has 205 students. **About how many students go to the 3 schools?** **A.** Estimate the number of students at North School. Describe your strategy. **B.** Estimate the number of students at Lakeview School. Describe your strategy. **C.** Estimate the total number of students at the 3 schools. Describe your strategy. **Answers** **A.** For example, about 200; the bar for North School is a little shorter than the bar for South School, so there are slightly fewer students than 205. **B.** For example, about 400; the bar for Lakeview School is about twice as long as the bar for each of the other schools. **C.** For example, about 800 200 + 400 + 200 = 800 Use Questions 1–3.
Lesson 1: Adding Mentally, pp. 88–89	• solve problems involving the addition, [subtraction, multiplication, and division] of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts,] using a variety of strategies – add [and subtract] two-digit numbers, using a variety of mental strategies	
Lesson 2: Estimating Sums, pp. 90–91	• solve problems involving the addition, [subtraction, multiplication, and division] of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts,] using a variety of strategies – use estimation when solving problems involving the addition, [subtraction, and multiplication] of whole numbers, [to help judge the reasonableness of a solution]	
Lesson 3: Communicate About Number Concepts and Procedures, pp. 92–93	• solve problems involving the addition, [subtraction, multiplication, and division] of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts,] using a variety of strategies – use estimation when solving problems involving the addition, [subtraction, and multiplication] of whole numbers, to help judge the reasonableness of a solution	
Lesson 4: Adding 4-Digit Numbers, pp. 94–96	• solve problems involving the addition, [subtraction, multiplication, and division] of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts,] using a variety of strategies – add [and subtract] two-digit numbers, using a variety of mental strategies – solve problems involving the addition [and subtraction] of four-digit numbers, using student-generated algorithms and standard algorithms – use estimation when solving problems involving the addition, [subtraction, and multiplication] of whole numbers, to help judge the reasonableness of a solution	

Content	Expectations	Addressing Expectations
Math Game: Race to 150, p. 97		Optional
Mid-Chapter Review: p. 98		Assessment Opportunity
Mental Math: Subtract by Adding On, p. 99		Optional
Lesson 5: Subtracting Mentally, pp. 100–101	• solve problems involving the [addition,] subtraction, [multiplication, and division] of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts,] using a variety of strategies – [add and] subtract two-digit numbers, using a variety of mental strategies	
Lesson 6: Estimating Differences, p. 102	• solve problems involving the addition, subtraction, [multiplication, and division] of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts,] using a variety of strategies – use estimation when solving problems involving the [addition,] subtraction, [and multiplication] of whole numbers, [to help judge the reasonableness of a solution]	
Math Game: River Crossing, p. 103		Optional
Lesson 7: Subtracting from 4-Digit Numbers, pp. 104–106	• solve problems involving the [addition], subtraction [multiplication, and division] of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts,] using a variety of strategies – solve problems involving the [addition and] subtraction of four-digit numbers, using student-generated algorithms and standard algorithms – use estimation when solving problems involving the [addition,] subtraction, [and multiplication] of whole numbers, to help judge the reasonableness of a solution	
Curious Math: Hidden Digits, p. 107		Optional
Lesson 8: Subtracting in a Different Way, pp. 108–109	• solve problems involving the addition, subtraction, [multiplication, and division] of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts,] using a variety of strategies – solve problems involving the addition and subtraction of four-digit numbers, using student-generated algorithms and standard algorithms – use estimation when solving problems involving the [addition,] subtraction [and multiplication] of whole numbers, to help judge the reasonableness of a solution	
Lesson A: Subtracting 4-Digit Numbers, Supplement, pp. 58–59	• solve problems involving the addition, subtraction, [multiplication, and division] of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts,] using a variety of strategies – solve problems involving the addition and subtraction of four-digit numbers, using student-generated algorithms and standard algorithms – use estimation when solving problems involving the [addition,] subtraction, [and multiplication] of whole numbers, to help judge the reasonableness of a solution	New Lesson
Lesson 9: Making Change, pp. 110–111	• solve problems [involving the addition, subtraction, multiplication, and division of single- and multi-digit whole numbers, and] involving the addition and subtraction of [decimal numbers to tenths and] money amounts, using a variety of strategies – add and subtract money amounts by making simulated purchases and providing change for amounts up to $100, using a variety of tools	***Teaching and Learning:*** On pp. 110–111 of the Student Book, change is made from amounts up to $50; however, amounts up to $100 are required. Include a question with a $100 bill and an item that costs $70.37. Guide students to use a number line to find the amount of change. ***Consolidation:*** Include a few questions with bills representing amounts up to $100 and prices greater than $50.
Lesson 10: Adding and Subtracting Money, pp. 112–113	• solve problems [involving the addition, subtraction, multiplication, and division of single- and multi-digit whole numbers, and] involving the addition and subtraction of [decimal numbers to tenths and] money amounts, using a variety of strategies – add and subtract money amounts by making simulated purchases and providing change for amounts up to $100, using a variety of tools	***Consolidation:*** On pp. 112–113 of the Student Book, amounts go to $50; however, amounts up to $100 are required. Change amounts to include questions with sums up to $100, and with subtraction from amounts up to $100.

Content	Expectations	Addressing Expectations
Skills Bank: pp. 114–116		Optional
Problem Bank: pp. 117–118		Optional
Chapter Review: p. 119		Assessment Opportunity
Chapter Task: On the Move, p. 120	• solve problems involving the addition, subtraction, [multiplication, and division] of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts,] using a variety of strategies – solve problems involving the addition and subtraction of four-digit numbers, using student-generated algorithms and standard algorithms – use estimation when solving problems involving the addition, subtraction, [and multiplication] of whole numbers, to help judge the reasonableness of a solution • read, describe, and interpret [primary data and] secondary data presented in [charts and] graphs, [including stem-and-leaf plots and double bar graphs] – [collect and organize discrete primary data and] display the data in [charts, tables, and] graphs [(including stem-and-leaf plots and double bar graphs)] that have appropriate titles, labels, and scales that suit the range and distribution of the data, using a variety of tools – read, interpret, and draw conclusions [from primary data and] from secondary data, presented in [charts, tables, and] graphs [(including stem-and-leaf plots and double bar graphs)]	Assessment Opportunity

Chapter 5 Planning Chart: Measuring Length and Time

Content	Expectations	Addressing Expectations
Getting Started: Surrounding Shapes, pp. 122–123		Assessment Opportunity
Lesson 1: Measuring with Decimetres, pp. 124–125	• estimate, measure, and record length, [perimeter, area, mass, capacity, volume, and elapsed time,] using a variety of strategies • determine the relationships among units [and measurable attributes, including the area and perimeter of rectangles] – estimate, measure, and record length, height, and distance, using standard units [(i.e., millimetre,] centimetre, [metre, kilometre]) – draw items using a ruler, given specific lengths in [millimetres or] centimetres – describe, through investigation, the relationship between various units of length (i.e., [millimetre,] centimetre, decimetre, metre, [kilometre]) – select and justify the most appropriate standard unit (i.e., [millimetre,] centimetre, decimetre, metre, [kilometre]) to measure [the side] lengths [and perimeters of various polygons]	***Consolidation:*** Include questions similar to Questions 3 and 4 but for height and for distance. For example: Find an object higher than 4 dm. Find a distance about 3 dm, longer than 3 dm, between 1 dm and 10 dm. Building on prompt D, provide questions about lengths, heights, and distances in centimetres. For example: Find an object longer than 12 cm, higher than 25 cm, and about 19 cm tall. Find a distance of about 95 cm, shorter than 85 cm. After Question 5, have students use the straight edge of an object to draw a line that they estimate is 8 cm long. Have them use a ruler to draw a line 8 cm long below it. Ask them to compare the lengths. Repeat this procedure for other lengths in centimetres.
Lesson 2: Measuring with Millimetres, pp. 126–127	• estimate, measure, and record length, [perimeter, area, mass, capacity, volume, and elapsed time,] using a variety of strategies • determine the relationships among units [and measurable attributes, including the area and perimeter of rectangles] – estimate, measure, and record length, height, and distance, using standard units (i.e., millimetre, centimetre, [metre, kilometre]) – draw items using a ruler, given specific lengths in millimetres [or centimetres] – describe, through investigation, the relationship between various units of length (i.e., millimetre, centimetre, decimetre, metre, [kilometre]) – select and justify the most appropriate standard unit (i.e., millimetre, centimetre, decimetre, metre, kilometre) to measure [the side] lengths [and perimeters of various polygons]	***Teaching and Learning:*** When discussing responses for Question 2, include distances between cities for long distances not measured in millimetres. Discuss why these would be measured in kilometres. Ask students about signs they have seen on highways with distances given in kilometres. Ask why these distances are in kilometres. ***Consolidation:*** Add parts to Question 5 about estimating and measuring heights and distances in millimetres, for example, the height of a coin and the distance between buttons on a coat. After Question 6, have students draw lines that they estimate are 16 mm long. Then have students use a ruler to draw a line 16 mm long and compare the lines. Continue with other lengths in millimetres.
Lesson 3: Record Measures Using Multiple Units, pp. 128–129	• estimate, measure, and record length, [perimeter, area, mass, capacity, volume, and elapsed time,] using a variety of strategies • determine the relationships among units [and measurable attributes, including the area and perimeter of rectangles] – estimate, measure, and record length, height, and distance, using standard units (i.e., millimetre, centimetre, metre, [kilometre]) – describe, through investigation, the relationship between various units of length (i.e., millimetre, centimetre, [decimetre,] metre, [kilometre]) – select and justify the most appropriate standard unit (i.e., millimetre, centimetre, [decimetre,] metre, [kilometre]) to measure [the side] lengths [and perimeters of various polygons]	***Teaching and Learning:*** Add parts on decimetres to prompt C: c) Use both decimetres and centimetres: ■ dm ■ cm d) Use only decimetres: ■ dm ***Consolidation:*** Include a few questions with decimetres. 9. Complete each measurement. a) 54 cm = ■ dm ■ cm (5 dm 4 cm) b) 8 m 2 dm = ■ dm (82 dm)
Lesson 4: Solve Problems by Drawing Diagrams, pp. 130–131	• [estimate, measure, and] record length, [perimeter, area, mass, capacity, volume, and elapsed time,] using a variety of strategies • determine the relationships among units [and measurable attributes, including the area and perimeter of rectangles] – estimate, measure, and record [length, height, and] distance, using standard units (i.e., [millimetre, centimetre,] metre, kilometre) – describe, through investigation, the relationship between various units of length (i.e., [millimetre, centimetre, decimetre,] metre, kilometre)	***Introduction:*** Relate kilometres to distances that are familiar to students. Name a place that is 1 km from the school. Ask students to name places they estimate are 1 km away. Explain that 1 km = 1000 m. Ask students about highway signs showing kilometres. ***Consolidation:*** Guide students to use a trundle wheel to measure classroom distances in metres. Have pairs measure a distance of 1 km by using a trundle wheel while walking 1 km to a nearby place or around the school several times. Or, have students walk 100 m with a trundle wheel. Help them complete a chart showing 100 m, 200 m, 300 m, …, 1000 m. Discuss the number of times they would need to walk that distance for 1 km.
Mid-Chapter Review: p. 132		Assessment Opportunity
Curious Math: Cutting and Measuring, p. 133		Optional

Content	Expectations	Addressing Expectations
Lesson A: Measuring Perimeter, Supplement, pp. 61–62	• estimate, measure, and record [length,] perimeter, [area, mass, capacity, volume, and elapsed time,] using a variety of strategies • determine the relationships among units and measurable attributes, including the [area and] perimeter [of rectangles] – estimate, measure using a variety of tools and strategies, and record the perimeter [and area] of polygons – select and justify the most appropriate standard unit (i.e., millimetre, centimetre, decimetre, metre, kilometre) to measure the side lengths and perimeters of various polygons – compare, using a variety of tools, two-dimensional shapes that have the same perimeter [or the same area]	New Lesson
Lesson 5: Perimeter of Rectangles, pp. 134–135	• estimate, measure, and record [length,] perimeter, [area, mass, capacity, volume, and elapsed time,] using a variety of strategies • determine the relationships among units and measurable attributes, including the [area and] perimeter of rectangles – estimate, measure using a variety of tools and strategies, and record the perimeter [and area] of polygons – determine, through investigation, the relationship between the side lengths of a rectangle and its perimeter [and area] – compare, using a variety of tools, two-dimensional shapes that have the same perimeter [or the same area]	***Teaching and Learning:*** Tell students to estimate the perimeter of each rectangle in geoboard units before calculating. Ask them to explain their estimation strategies. ***Consolidation:*** Have students use geoboards and elastics, or dot paper, to create different rectangles with the same perimeter. Invite students to present their rectangles to classmates and explain their strategies.
Lesson 6: Decades, Centuries, and Millenniums, pp. 136–137	• estimate, [measure,] and record [length, perimeter, area, mass, capacity, volume, and] elapsed time, using a variety of strategies • determine the relationships among units [and measurable attributes, including the area and perimeter of rectangles] – estimate and determine elapsed time, with and without using a time line, given the durations of events expressed in [five-minute intervals, hours, days, weeks, months, or] years – solve problems involving the relationship between years and decades, and between decades and centuries	Since millennium is not required for the Grade 4 curriculum, use prompts A to E, prompt H without the word millennium, and Question 1a), b). ***Teaching and Learning:*** Include the following Reflecting question: 2. How could you complete Part H without using a time line? Encourage discussion about various strategies.
Mental Imagery: Estimating Length, p. 137		Optional
Lesson 7: Time in Minutes, pp. 138–139	• estimate, measure, and record [length, perimeter, area, mass, capacity, volume, and] elapsed time, using a variety of strategies – estimate, measure (i.e., using an analog clock), and represent time intervals to the nearest minute	***Teaching and Learning:*** Have students estimate lengths of time in minutes. They could use times to the nearest 5 or 10 minutes or count by 5s on the clocks. Encourage students to suggest other strategies. Have students represent time intervals on a clock. For example, they can draw the hands on a clock for the times 56 minutes after 11:42 a.m. and 134 minutes after 5:14 p.m. Provide clocks.
Lesson B: Lengths of Time, Supplement, p. 64	• estimate, [measure,] and record [length, perimeter, area, mass, capacity, volume, and] elapsed time, using a variety of strategies – estimate and determine elapsed time, with and without using a time line, given the durations of events expressed in five-minute intervals, hours, days, weeks, months, [or years]	New Lesson
Skills Bank: pp. 140–141		Optional: Select from Questions 1–10, 11a), c), d), 12.
Problem Bank: p. 142		Optional
Chapter Review: p. 143		Assessment Opportunity: Use Question 1–7, 9.
Chapter Review: Supplement, p. 66		New Assessment Opportunity
Chapter Task: Suncatchers, p. 144	• estimate, measure, and record length, perimeter, [area, mass, capacity, volume, and elapsed time,] using a variety of strategies • determine the relationships among units and measurable attributes, including the [area and] perimeter of rectangles – estimate, measure, and record length, [height, and distance,] using standard units (i.e., [millimetre,] centimetre, [metre, kilometre]) – select and justify the most appropriate standard unit (i.e., millimetre, centimetre, decimetre, [metre, kilometre]) to measure the side lengths and perimeters of various polygons	Assessment Opportunity: Ask students to explain their choices of units.

Chapter 6 Planning Chart: Multiplication and Division Facts

Content	Expectations	Addressing Expectations
Getting Started: Patterns in a Multiplication Table, pp. 146–147		Assessment Opportunity
Lesson 1: Use Doubling to Multiply, pp. 148–149	• solve problems involving the addition, [subtraction,] multiplication, [and division] of single- [and multi-] digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts, using a variety of strategies] – multiply to 9 × 9 [and divide to 81 ÷ 9], using a variety of mental strategies – solve problems involving the multiplication of one-digit whole numbers, using a variety of mental strategies	
Lesson 2: Sharing and Grouping, pp. 150–151	• solve problems involving the [addition, subtraction, multiplication, and] division of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts, using a variety of strategies] – [multiply to 9 × 9 and] divide to 81 ÷ 9, using a variety of mental strategies	
Lesson 3: Division and Multiplication, pp. 152–153	• solve problems involving the addition, subtraction, multiplication, and division of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts, using a variety of strategies] • demonstrate an understanding of proportional reasoning by investigating whole-number unit rates – multiply to 9 × 9 and divide to 81 ÷ 9, using a variety of mental strategies – solve problems involving the multiplication of one-digit whole numbers, using a variety of mental strategies – describe relationships that involve simple whole-number multiplication – demonstrate an understanding of simple multiplicative relationships involving unit rates, through investigation using concrete materials and drawings • demonstrate an understanding of equality between pairs of expressions, using addition, [subtraction,] and multiplication – determine, through investigation, the inverse relationship between multiplication and division	***Teaching and Learning:*** Discuss with students how a number line shows a multiplicative relationship for the amount for each person. Ask, "If 1 person gets $5, how much do 2 people get? How much do 3 people get? How much do 4 people get?"
Lesson 4: Arrays for Fact Families, pp. 154–155	• solve problems involving the [addition, subtraction,] multiplication, and division of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts, using a variety of strategies] • demonstrate an understanding of proportional reasoning by investigating whole-number unit rates – multiply to 9 × 9 and divide to 81 ÷ 9, using a variety of mental strategies – solve problems involving the multiplication of one-digit whole numbers, using a variety of mental strategies – describe relationships that involve simple whole-number multiplication – demonstrate an understanding of simple multiplicative relationships involving unit rates, through investigation using concrete materials and drawings – demonstrate an understanding of equality between pairs of expressions, using [addition, subtraction, and] multiplication – determine, through investigation, the inverse relationship between multiplication and division – determine the missing number in equations involving multiplication of one- [and two-]digit numbers, using a variety of tools and strategies – identify, through investigation, and use the commutative property of multiplication to facilitate computation with whole numbers	***Teaching and Learning:*** Ask questions about how an array shows the multiplicative relationship for the number of rows or columns of cards. For example, ask, "If 1 row has 6 cards, how many cards do 2 rows have? How many cards do 3 rows have? How many cards do 4 rows have? How many cards do 5 rows have?" Present the multiplication sentence 6 × ■ = 12 and ask, "How can you use the array of cards to find the missing factor?" Guide students to realize that the factor 6 represents the number of columns in the array of cards and the missing factor represents the number of rows, which is 2. So the missing factor is 2. Then ask, "How could you determine the missing factor in 6 × ■ = 12 without materials?" Elicit from students that since 6 × 2 = 12, they know the missing factor is 2. Continue with a few other examples. ***Consolidation:*** Provide questions such as 6 × ■ = 30, ■ × 9 = 36, 7 × ■ = 21, and ■ × 8 = 48 for students to find the missing factors. Then ask them to explain their strategies.
Lesson 5: Using Facts to Multiply Larger Numbers, pp. 156–157	• demonstrate an understanding of proportional reasoning by investigating whole-number unit rates – demonstrate an understanding of simple multiplicative relationships involving unit rates, through investigation, using concrete materials and drawings	

Content	Expectations	Addressing Expectations
Lesson 6: Solve Problems by Making Models, pp. 158–159	• solve problems involving the [addition, subtraction,] multiplication, and division of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts, using a variety of strategies] • demonstrate an understanding of proportional reasoning by investigating whole-number unit rates – multiply to 9 × 9 and divide to 81 ÷ 9, using a variety of mental strategies – solve problems involving the multiplication of one-digit whole numbers, using a variety of mental strategies – describe relationships that involve simple whole-number multiplication – determine, through investigation, the inverse relationship between multiplication and division	***Teaching and Learning:*** Guide students to talk about relationships that involve whole-number multiplication by asking questions such as, "If Terry puts 2 of his 8 jars on each shelf, how many shelves will he use? How does your model show this?"
Mid-Chapter Review: p. 160		Assessment Opportunity
Curious Math: Multiplying and Dividing with 0, p. 161	• solve problems involving the [addition, subtraction,] multiplication, and division of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts, using a variety of strategies] – multiply [to 9 × 9] and divide [to 81 ÷ 9], using a variety of mental strategies – solve problems involving the multiplication of one-digit whole numbers, using a variety of mental strategies – demonstrate an understanding of equality between pairs of expressions, using [addition, subtraction, and] multiplication – determine, through investigation, the inverse relationship between multiplication and division	This offers the opportunity to focus on multiplying by zero and on dividing zero.
Lesson 7: Halving Strategies: Facts with 5 and 10, pp. 162–163	• solve problems involving the [addition, subtraction,] multiplication, and division of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts, using a variety of strategies] – multiply to 9 × 9 and divide to 81 ÷ 9, using a variety of mental strategies – solve problems involving the multiplication of one-digit whole numbers, using a variety of mental strategies • demonstrate an understanding of equality between pairs of expressions, using [addition, subtraction, and] multiplication – determine, through investigation, the inverse relationship between multiplication and division	
Lesson 8: Adding On: Facts with 3 and 6, pp. 164–165	• solve problems involving the [addition, subtraction,] multiplication, and division of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts, using a variety of strategies] – multiply [to 9 × 9] and divide [to 81 ÷ 9], using a variety of mental strategies – solve problems involving the multiplication of one-digit whole numbers, using a variety of mental strategies • demonstrate an understanding of equality between pairs of expressions, using [addition, subtraction, and] multiplication – determine, through investigation, the inverse relationship between multiplication and division	
Lesson 9: Subtracting Strategy: Facts with 9, p. 166	• solve problems involving the [addition, subtraction,] multiplication, and division of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts, using a variety of strategies] – multiply to 9 × 9 and divide to 81 ÷ 9, using a variety of mental strategies – solve problems involving the multiplication of one-digit whole numbers, using a variety of mental strategies • demonstrate an understanding of equality between pairs of expressions, using [addition, subtraction, and] multiplication – determine, through investigation, the inverse relationship between multiplication and division	
Curious Math: Multiplying with 9, p. 167		Optional
Mental Math: Adding the Middle, p. 167		Optional

Content	Expectations	Addressing Expectations
Lesson 10: Number Neighbours: Facts with 7 and 8, pp. 168–169	• solve problems involving the [addition, subtraction,] multiplication, and division of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts, using a variety of strategies] – multiply [to 9 × 9] and divide [to 81 ÷ 9], using a variety of mental strategies – solve problems involving the multiplication of one-digit whole numbers, using a variety of mental strategies • demonstrate an understanding of equality between pairs of expressions, using [addition, subtraction, and] multiplication – determine, through investigation, the inverse relationship between multiplication and division – determine the missing number in equations involving multiplication of one- [and two-]digit numbers, using a variety of tools and strategies	***Teaching and Learning:*** Ask students to explain how they can use Shani's ladybugs to find the missing factor in 7 × ■ = 42. Discuss that 42 can represent the number of legs for 7 ladybugs, and each ladybug has 6 legs, so the missing factor is 6. ***Consolidation:*** Provide questions such as 7 × ■ = 45, ■ × 8 = 64, 9 × ■ = 72, and ■ × 6 = 42 for students to find the missing factors. Have students use a calculator to check. Then ask them to explain their strategies. Include in the discussion strategies such as using a multiplication table, thinking of spider legs, using counters, and thinking of fact families.
Curious Math: Circles and Digits, p. 170		Optional
Math Game: Math Cat, p. 171		Optional
Skills Bank: pp. 172–174		Optional
Problem Bank: p. 175–176		Optional
Chapter Review: p. 177		Assessment Opportunity
Chapter Task: Arrays on Parade, p. 178	• solve problems involving the [addition, subtraction,] multiplication, and division of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts, using a variety of strategies] • demonstrate an understanding of proportional reasoning by investigating whole-number unit rates – multiply to 9 × 9 and divide to 81 ÷ 9, using a variety of mental strategies – solve problems involving the multiplication of one-digit whole numbers, using a variety of mental strategies – describe relationships that involve simple whole-number multiplication – demonstrate an understanding of simple multiplicative relationships involving unit rates, through investigation, using concrete materials and drawings • demonstrate an understanding of equality between pairs of expressions, using [addition, subtraction, and] multiplication – determine, through investigation, the inverse relationship between multiplication and division – identify, through investigation, and use the commutative property of multiplication to facilitate computation with whole numbers	Assessment Opportunity

Chapter 7 Planning Chart: 2-D Geometry

Content	Expectations	Addressing Expectations
Getting Started: Exploring Geometry with Puzzles, pp. 68–69		Assessment Opportunity
Lesson A: Comparing Angles, Supplement, pp. 68–69	• identify quadrilaterals and three-dimensional figures and classify them by their geometric properties, and compare various angles to benchmarks – identify benchmark angles (i.e., straight angle, right angle, half a right angle), using a reference tool, and compare other angles to these benchmarks – relate the names of the benchmark angles to their measures in degrees	New Lesson
Lesson 1: Classifying Quadrilaterals, pp. 182–183	• identify quadrilaterals [and three-dimensional figures] and classify them by their geometric properties, [and compare various angles to benchmarks] – identify and compare different types of quadrilaterals (i.e., rectangle, square, trapezoid, parallelogram, rhombus) and sort and classify them by their geometric properties	***Teaching and Learning:*** When discussing definitions of quadrilaterals, remind students that square corners are called right angles. For prompt F, have students also sort quadrilaterals by angles, for example, one loop for quadrilaterals with 4 right angles and the other loop for quadrilaterals with at least 2 angles that are greater than a right angle and less than a straight angle.
Lesson 2: Building Quadrilaterals, p. 184	• identify quadrilaterals [and three-dimensional figures] and classify them by their geometric properties, [and compare various angles to benchmarks] – identify and compare different types of quadrilaterals (i.e., rectangle, square, trapezoid, parallelogram, rhombus) and sort and classify them by their geometric properties	
Curious Math: Tangram Quadrilaterals, p. 185		Optional
Lesson 3: Congruent Shapes, pp. 186–187	• identify quadrilaterals [and three-dimensional figures] and classify them by their geometric properties, [and compare various angles to benchmarks] – identify and compare different types of quadrilaterals (i.e., rectangle, square, trapezoid, parallelogram, rhombus) [and sort and classify them by their geometric properties]	
Lesson 4: Similar Shapes, pp. 188–189		Beyond Grade 4 curriculum
Curious Math: A Similarity Test, p. 190		Beyond Grade 4 curriculum
Mid-Chapter Review: p. 191		Assessment Opportunity: Use Questions 1–2.
Lesson 5: Measuring Angles, pp. 192–194		Beyond Grade 4 curriculum
Mental Imagery: Building Shapes from Triangles, p. 195		Optional
Lesson 6: Solve Problems by Acting Them Out, pp. 196–197	• describe, extend, and create a variety of numeric and geometric patterns, [make predictions related to the patterns, and investigate repeating patterns involving reflections] – extend, describe, and create [repeating,] growing, [and shrinking] number patterns – make predictions related to repeating geometric and numeric patterns	
Lesson 7: Lines of Symmetry, pp. 198–199	• [identify quadrilaterals and three-dimensional figures and] classify [them] by their geometric properties, [and compare various angles to benchmarks] – draw the lines of symmetry of two-dimensional shapes, through investigation using a variety of tools and strategies	***Teaching and Learning:*** Ask, "When you draw a line of symmetry, do you create congruent shapes?" (Yes.) "How do you know?" (By placing one part over the other to match them.)

Content	Expectations	Addressing Expectations
Lesson 8: Classifying 2-D Shapes, p. 200	• identify quadrilaterals [and three-dimensional figures] and classify them by their geometric properties, and compare various angles to benchmarks – draw the lines of symmetry of two-dimensional shapes, through investigation using a variety of tools and strategies – identify and compare different types of quadrilaterals (i.e., rectangle, square, trapezoid, parallelogram, rhombus) and sort and classify them by their geometric properties	***Teaching and Learning:*** Since using a protractor to measure angles is beyond the Grade 4 curriculum, have students use folded paper to compare angles as in Lesson 7A. Tell students to leave out similarity as an attribute. Similarity is beyond the Grade 4 curriculum. Have pairs make their own quadrilaterals that include rectangles, squares, trapezoids, parallelograms, and rhombuses. They could trace pattern blocks for some of the shapes. Then tell the pairs to sort their quadrilaterals by properties such as sides of equal length, parallel sides, symmetry, or number of right angles. Pairs can trade all or some of their quadrilaterals to sort again.
Math Game: Playing the Angles, p. 201		Beyond Grade 4 curriculum
Skills Bank: pp. 202–203		Optional: Select from Questions 1–3, 6, 7 (without the similarity attribute).
Problem Bank: p. 204		Optional: Select from Questions 1–4.
Chapter Review: p. 205		Assessment Opportunity: Use Questions 1–2, 5–6.
Chapter Review: Supplement, p. 71		New Assessment Opportunity
Chapter Task: Shape Names, p. 206		Beyond Grade 4 curriculum
Chapter Task: Shape Names, Supplement, p. 73	• identify quadrilaterals [and three-dimensional figures] and classify them by their geometric properties, and compare various angles to benchmarks – draw the lines of symmetry of two-dimensional shapes, through investigation using a variety of tools and strategies – identify and compare different types of quadrilaterals (i.e., rectangle, square, trapezoid, parallelogram, rhombus) [and sort] and classify them by their geometric properties – identify benchmark angles (i.e., straight angle, right angle, half a right angle), using a reference tool, and compare other angles to these benchmarks	New Assessment Opportunity: Select notes from the Teacher's Resource for Chapter Task: Shape Names on p. 206 of the Student Book to support the new Chapter Task.
Chapters 4–7 Cumulative Review: pp. 207–208		Assessment Opportunity: Select from Questions 1–5, 6 (using folded paper instead of a protractor), 7a), c), 8–9.

Chapter 8 Planning Chart: Area and Grids

Content	Expectations	Addressing Expectations
Getting Started: Comparing Area, pp. 210–211		Assessment Opportunity
Lesson 1: Standard Area Units, pp. 212–213	• [estimate,] measure, and record [length, perimeter,] area, [mass, capacity, volume, and elapsed time,] using a variety of strategies • determine the relationships among units and measurable attributes, including the area [and perimeter] of rectangles – [estimate,] measure using a variety of tools and strategies, and record the [perimeter and] area of polygons – pose and solve meaningful problems that require the ability to distinguish perimeter and area	***Teaching and Learning:*** When discussing Question 3, emphasize the difference between perimeter and area. Discuss that area is measured with shapes that cover the surface, whereas perimeter can be measured in centimetres or millimetres. Guide students to pose problems related to the difference between perimeter and area. Suggest that students ask about reasons for finding the perimeter or area of a shape.
Mental Imagery: Cutting and Moving, p. 213		Optional
Lesson 2: Square Centimetres, pp. 214–216	• estimate, measure, and record [length, perimeter,] area, [mass, capacity, volume, and elapsed time,] using a variety of strategies • determine the relationships among units and measurable attributes, including the area [and perimeter] of rectangles – estimate, measure using a variety of tools and strategies, and record the [perimeter and] area of polygons – compare, using a variety of tools, two-dimensional shapes that have [the same perimeter or] the same area	
Math Game: Area Logic, p. 217		Optional
Lesson 3: Square Metres, pp. 218–219	• estimate, [measure,] and record [length,] perimeter, area, [mass, capacity, volume, and elapsed time,] using a variety of strategies • determine the relationships among units and measurable attributes, including the area and perimeter of rectangles – estimate, [measure] using a variety of tools and strategies, and record the perimeter and area of polygons – pose and solve meaningful problems that require the ability to distinguish perimeter and area	***Teaching and Learning:*** Ask, "How is estimating area different from estimating perimeter? Would you estimate area or perimeter to find out how much trim you need for a door? Why?" Lead students to pose problems asking for an estimated area or an estimated perimeter. Then ask, "How does the problem show whether you should estimate an area or a perimeter?"
Mid-Chapter Review: p. 220		Assessment Opportunity
Curious Math: Area on Board, p. 221		Optional
Lesson 4: Relating Linear Dimensions and Area, pp. 222–224	• estimate, measure, and record length, [perimeter,] area, [mass, capacity, volume, and elapsed time,] using a variety of strategies • determine the relationships among units and measurable attributes, including the area [and perimeter] of rectangles – estimate, measure using a variety of tools and strategies, and record the perimeter and area of polygons – determine, through investigation, the relationship between the side lengths of a rectangle and its [perimeter and] area	
Lesson 5: Relating Shape, Area, and Perimeter, p. 225	• estimate, measure, and record [length,] perimeter, area, [mass, capacity, volume, and elapsed time,] using a variety of strategies • determine the relationships among units and measurable attributes, including the area and perimeter [of rectangles] – estimate, measure using a variety of tools and strategies, and record the perimeter and area of polygons – pose and solve meaningful problems that require the ability to distinguish perimeter and area – compare, using a variety of tools, two-dimensional shapes that have [the same perimeter or] the same area	***Teaching and Learning:*** Extend Question 3 to guide students by using their answers to part b) to pose problems that require distinguishing between perimeter and area. Then ask students to make up their own problems.

Content	Expectations	Addressing Expectations
Lesson 6: Solve Problems Using Organized Lists, pp. 226–227	• estimate, measure, and record length, [perimeter,] area, [mass, capacity, volume, and elapsed time,] using a variety of strategies • determine the relationships among units and measurable attributes, including the area [and perimeter] of rectangles – estimate, measure using a variety of tools and strategies, and record the [perimeter and] area of polygons – determine, through investigation, the relationship between the side lengths of a rectangle and its [perimeter and] area – compare, using a variety of tools, two-dimensional shapes that have [the same perimeter or] the same area	
Skills Bank: pp. 228–229		Optional
Problem Bank: p. 230		Optional
Chapter Review: p. 231		Assessment Opportunity
Chapter Task: Design a Petting Zoo, p. 232	• estimate, measure, and record length, perimeter, area, [mass, capacity, volume, and elapsed time,] using a variety of strategies • determine the relationships among units and measurable attributes, including the area and perimeter of rectangles – estimate, measure using a variety of tools and strategies, and record the perimeter and area of polygons – determine, through investigation, the relationship between the side lengths of a rectangle and its perimeter and area – [pose and] solve meaningful problems that require the ability to distinguish perimeter and area	Assessment Opportunity

Chapter 9 Planning Chart: Multiplying Greater Numbers

Content	Expectations	Addressing Expectations
Getting Started: Making Multiplication Facts, pp. 234–235		Assessment Opportunity
Lesson 1: Exploring Multiplication, p. 236	• solve problems involving the [addition, subtraction,] multiplication, [and division] of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts,] using a variety of strategies • demonstrate an understanding of proportional reasoning by investigating whole-number unit rates – multiply two-digit whole numbers by one-digit whole numbers, using a variety of tools, student-generated algorithms, [and standard algorithms] – demonstrate an understanding of simple multiplicative relationships involving unit rates, through investigation using concrete materials and drawings • demonstrate an understanding of equality between pairs of expressions, using [addition, subtraction, and] multiplication – identify, through investigation, and use the commutative property of multiplication to facilitate computation with whole numbers	
Curious Math: Persistent Numbers, p. 237		Optional
Curious Math: Sum and Product, p. 237		Optional
Lesson 2: Multiplying with Arrays, pp. 238–239	• solve problems involving the [addition, subtraction,] multiplication, [and division] of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts,] using a variety of strategies – multiply two-digit whole numbers by one-digit whole numbers, using a variety of tools, student-generated algorithms, [and standard algorithms] – use estimation when solving problems involving the [addition, subtraction, and] multiplication of whole numbers, to help judge the reasonableness of a solution • demonstrate an understanding of equality between pairs of expressions, using [addition, subtraction, and] multiplication – identify, through investigation, and use the distributive property of multiplication over addition to facilitate computation with whole numbers	
Lesson 3: Multiplying in Expanded Form, pp. 240–241	• solve problems involving the [addition, subtraction,] multiplication, [and division] of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts,] using a variety of strategies – multiply two-digit whole numbers by one-digit whole numbers, using a variety of tools, student-generated algorithms, [and standard algorithms] – use estimation when solving problems involving the [addition, subtraction, and] multiplication of whole numbers, to help judge the reasonableness of a solution • demonstrate an understanding of equality between pairs of expressions, using [addition, subtraction, and] multiplication – identify, through investigation, and use the distributive property of multiplication over addition to facilitate computation with whole numbers	***Consolidation:*** After students calculate each product for Question 4, they should use their estimates to check whether their calculations are reasonable.
Mid-Chapter Review: p. 242		Assessment Opportunity
Mental Math: Adding Numbers Near 100, p. 243		Optional

Content	Expectations	Addressing Expectations
Lesson 4: Communicate About Solving Problems, pp. 244–245	• solve problems involving the [addition, subtraction,] multiplication, [and division] of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts,] using a variety of strategies • demonstrate an understanding of proportional reasoning by investigating whole-number unit rates – multiply two-digit whole numbers by one-digit whole numbers, using a variety of tools, student-generated algorithms, [and standard algorithms] – use estimation when solving problems involving the [addition, subtraction, and] multiplication of whole numbers, to help judge the reasonableness of a solution – describe relationships that involve simple whole-number multiplication – demonstrate an understanding of simple multiplicative relationships involving unit rates, through investigation [using concrete materials and drawings] – describe, extend, and create a variety of numeric [and geometric] patterns, [make predictions related to the patterns, and investigate repeating patterns involving reflections] – extend, describe, and create [repeating,] growing, [and shrinking] number patterns – create a number pattern involving addition, subtraction, [or multiplication,] given a pattern rule expressed in words	
Lesson 5: Multiplying 3 Digits by 1 Digit, pp. 246–247		Beyond Grade 4 curriculum
Lesson 6: Multiplying with an Algorithm, pp. 248–250		Beyond Grade 4 curriculum
Lesson A: Multiplying with an Algorithm, Supplement, pp. 74–75	• solve problems involving the [addition, subtraction,] multiplication, [and division] of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts,] using a variety of strategies – multiply two-digit whole numbers by one-digit whole numbers, using a variety of tools, student-generated algorithms, and standard algorithms – use estimation when solving problems involving the [addition, subtraction, and] multiplication of whole numbers, to help judge the reasonableness of a solution	New Lesson
Lesson B: Multiplication Patterns, Supplement, p. 77	• demonstrate an understanding of proportional reasoning by investigating whole-number unit rates – describe relationships that involve simple whole-number multiplication – demonstrate an understanding of simple multiplicative relationships involving unit rates, through investigation using concrete materials and drawings • describe, extend, and create a variety of numeric [and geometric] patterns, [make predictions related to the patterns, and investigate repeating patterns involving reflections] – extend, describe, and create [repeating,] growing, [and shrinking] number patterns – connect each term in a growing [or shrinking] pattern with its term number, and record the patterns in a table of values that shows the term number and the term – create a number pattern involving [addition, subtraction, or] multiplication, given a pattern rule expressed in words	New Lesson
Math Game: Greatest Product, p. 251		The game is beyond the Grade 4 curriculum, but the second "other way to play" described can be played: Use a 1-digit by 2-digit game card.
Lesson 7: Choosing a Method to Multiply, pp. 252–253	• solve problems involving the [addition, subtraction,] multiplication, [and division] of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts,] using a variety of strategies • demonstrate an understanding of proportional reasoning by investigating whole-number unit rates – multiply to 9×9 [and divide to $81 \div 9$], using a variety of mental strategies – solve problems involving the multiplication of one-digit whole numbers, using a variety of mental strategies – multiply two-digit whole numbers by one-digit whole numbers, using a variety of tools, student-generated algorithms, and standard algorithms – use estimation when solving problems involving the [addition, subtraction, and] multiplication of whole numbers, [to help judge the reasonableness of a solution] – demonstrate an understanding of simple multiplicative relationships involving unit rates, through investigation, using concrete materials and drawings	Since the Grade 4 curriculum does not include multiplying 3-digit numbers by 1-digit numbers, choices of methods may vary from those suggested in the Teacher's Resource.

Content	Expectations	Addressing Expectations
Curious Math: Egyptian Multiplication, p. 253		Beyond Grade 4 curriculum
Skills Bank: pp. 254–256		Optional: Select from Questions 1–6, 12. Questions 5 and 6 could be used after Lesson 9B for students to multiply using an algorithm instead of expanded form. Answers for Question 12 may vary from those in the Teacher's Resource because multiplying 3-digit numbers is beyond the Grade 4 curriculum.
Problem Bank: p. 257		Optional: Select from Questions 1, 2.
Chapter Review: pp. 258–259		Assessment Opportunity: Use Questions 1–4, 9a), c), 10a), 12. Answers for Question 12 may vary from those in the Teacher's Resource because multiplying 3-digit numbers is beyond the Grade 4 curriculum.
Chapter Task: Describing a School Year, p. 260	• solve problems involving the [addition, subtraction,] multiplication, [and division] of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts,] using a variety of strategies • demonstrate an understanding of proportional reasoning by investigating whole-number unit rates – multiply two-digit whole numbers by one-digit whole numbers, using a variety of tools, student-generated algorithms, and standard algorithms – use estimation when solving problems involving the [addition, subtraction, and] multiplication of whole numbers, [to help judge the reasonableness of a solution] – demonstrate an understanding of simple multiplicative relationships involving unit rates, through investigation, using concrete materials and drawings	Assessment Opportunity: Students should use a calculator for the multiplication at the top of the page since it involves multiplying a 3-digit number, which is beyond the Grade 4 curriculum. Have students use a calculator for any prompts that require multiplication beyond a 2-digit number by a 1-digit number.

Chapter 10 Planning Chart: Dividing Greater Numbers

Content	Expectations	Addressing Expectations
Getting Started: Planning a Play Day, pp. 262–263		Assessment Opportunity
Lesson 1: Exploring Division, p. 264	• solve problems involving the [addition, subtraction, multiplication, and] division of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts,] using a variety of strategies • demonstrate an understanding of proportional reasoning by investigating whole-number unit rates – multiply two-digit whole numbers by one-digit whole numbers, using a variety of tools, student-generated algorithms, and standard algorithms – divide two-digit whole numbers by one-digit whole numbers, using a variety of tools and student-generated algorithms – determine, through investigation, the inverse relationship between multiplication and division • demonstrate an understanding of simple multiplicative relationships involving unit rates, through investigation, using concrete materials and drawings – demonstrate an understanding of equality between pairs of expressions, using [addition, subtraction, and] multiplication – determine, through investigation, the inverse relationship between multiplication and division	
Mental Math: Adding in Steps, p. 265		Optional
Lesson 2: Using Repeated Subtraction to Divide, pp. 266–267	• solve problems involving the [addition, subtraction, multiplication, and] division of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts,] using a variety of strategies – divide two-digit whole numbers by one-digit whole numbers, using a variety of tools and student-generated algorithms	***Teaching and Learning:*** Miki's Problem presents the remainder as the fraction $\frac{1}{2}$. Fraction form is new in Grade 4, and introduced in Chapter 12. In Miki's Problem, the words "eight and one half" can be used. ***Consolidation:*** As students write answers with fractions, have them use the words for the fractions, such as "three eighths."
Lesson 3: Interpreting Remainders, pp. 268–269	• solve problems involving the [addition, subtraction, multiplication, and] division of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts,] using a variety of strategies – divide two-digit whole numbers by one-digit whole numbers, using a variety of tools and student-generated algorithms	
Lesson 4: Dividing 2 Digits by 1 Digit, pp. 270–271	• solve problems involving the [addition, subtraction, multiplication, and] division of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts,] using a variety of strategies – divide two-digit whole numbers by one-digit whole numbers, using a variety of tools and student-generated algorithms	
Lesson 5: Solve Problems by Guessing and Testing, pp. 272–273	• solve problems involving the [addition, subtraction, multiplication, and] division of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts,] using a variety of strategies – multiply two-digit whole numbers by one-digit whole numbers, using a variety of tools, student-generated algorithms, and standard algorithms – divide two-digit whole numbers by one-digit whole numbers, using a variety of tools and student-generated algorithms • demonstrate an understanding of equality between pairs of expressions, using [addition, subtraction, and] multiplication – determine, through investigation, the inverse relationship between multiplication and division	
Mid-Chapter Review: p. 274		Assessment Opportunity
Math Game: Remainder Hunt, p. 275		Optional

Content	Expectations	Addressing Expectations
Lesson A: Missing Factors, Supplement, p. 79	• solve problems involving the [addition, subtraction, multiplication, and] division of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts,] using a variety of strategies – divide two-digit whole numbers by one-digit whole numbers, using a variety of tools and student-generated algorithms • demonstrate an understanding of equality between pairs of expressions, using [addition, subtraction, and] multiplication – determine, through investigation, the inverse relationship between multiplication and division – determine the missing number in equations involving multiplication of one- and two-digit numbers, using a variety of tools and strategies	New Lesson
Lesson 6: Estimating with 3-Digit Dividends, pp. 276–277		Beyond Grade 4 curriculum
Lesson 7: Dividing in Parts, pp. 278–279		Beyond Grade 4 curriculum
Lesson 8: Dividing 3 Digits by 1 Digit, pp. 280–282		Beyond Grade 4 curriculum
Curious Math: Finding the Mean, p. 283		Beyond Grade 4 curriculum
Skills Bank: pp. 284–286		Optional: Select from Questions 1–5.
Problem Bank: p. 287		Optional: Select from Questions 1–3.
Chapter Review: pp. 288–289		Assessment Opportunity: Use Questions 1–2, 12c). Use Question 5a) –c) without estimating.
Chapter Task: Printing Pages, p. 290		Beyond Grade 4 curriculum
Chapter Task: Printing Pages, Supplement, p. 81	• solve problems involving the [addition, subtraction, multiplication, and] division of single- and multi-digit whole numbers, [and involving the addition and subtraction of decimal numbers to tenths and money amounts,] using a variety of strategies – divide two-digit whole numbers by one-digit whole numbers, using a variety of tools and student-generated algorithms	New Assessment Opportunity

Chapter 11 Planning Chart: 3-D Geometry and 3-D Measurement

Content	Expectations	Addressing Expectations
Getting Started: Describing Packages, pp. 292–293		Assessment Opportunity: Use prompts A–D but without the word similar on the chart paper in the picture, and Questions 1–3.
Lesson 1: Sketching Faces, p. 294	• identify [quadrilaterals and] three-dimensional figures and classify them by their geometric properties, [and compare various angles to benchmarks] – identify and describe prisms and pyramids, and classify them by their geometric properties (i.e., shape of faces, number of edges, number of vertices), using concrete materials	
Curious Math: Faces, Edges, and Vertices. p. 295		Optional
Lesson 2: Building 3-D Shapes with Congruent Faces, p. 296	• identify [quadrilaterals and] three-dimensional figures and classify them by their geometric properties, [and compare various angles to benchmarks] • construct three-dimensional figures, using two-dimensional shapes – identify and describe prisms and pyramids, and classify them by their geometric properties (i.e., shape of faces, number of edges, number of vertices), using concrete materials – construct three-dimensional figures, using only congruent shapes	
Lesson A: Using Nets, Supplement, pp. 82–83	• construct three-dimensional figures, using two-dimensional shapes – draw and describe nets of rectangular and triangular prisms – construct prisms and pyramids from given nets	New Lesson
Mental Imagery: Cross-Sections, p. 297		Optional
Lesson 3: Making Skeleton Models, pp. 298–299	• identify [quadrilaterals and] three-dimensional figures and classify them by their geometric properties, [and compare various angles to benchmarks] • construct three-dimensional figures,] using two-dimensional shapes] – identify and describe prisms and pyramids, and classify them by their geometric properties (i.e., shape of faces, number of edges, number of vertices), using concrete materials – construct skeletons of three-dimensional figures, using a variety of tools, [and sketch the skeletons]	
Lesson B: Sketching Models, Supplement, p. 85	• construct skeletons of three-dimensional figures, using a variety of tools, and sketch the skeletons	New Lesson
Curious Math: Making Shadows, p. 299		Optional
Lesson 4: Drawing 3-D Shapes, pp. 300–301		Beyond Grade 4 curriculum
Lesson 5: Communicate an Understanding of Geometric Concepts, pp. 302–303	• identify [quadrilaterals and] three-dimensional figures and classify them by their geometric properties, [and compare various angles to benchmarks] • construct three-dimensional figures, [using two-dimensional shapes] – identify and describe prisms and pyramids, and classify them by their geometric properties (i.e., shape of faces, number of edges, number of vertices), using concrete materials – construct skeletons of three-dimensional figures, using a variety of tools, [and sketch the skeletons]	
Mid-Chapter Review: p. 304		Assessment Opportunity
Lesson 6: Measuring Mass, p. 305	• estimate, measure, and record [length, perimeter, area,] mass, [capacity, volume, and elapsed time,] using a variety of strategies • determine the relationships among units and measurable attributes, [including the area and perimeter of rectangles] – estimate, measure, and record the mass of objects, using the standard units of the kilogram and the gram – compare and order a collection of objects, using standard units of mass (i.e., gram, kilogram) [and/or capacity (i.e., millilitre, litre)] – determine, through investigation, the relationship between grams and kilograms – select and justify the most appropriate standard unit to measure mass (i.e., [milligram,] gram, kilogram) [and the most appropriate standard unit to measure the capacity of a container (i.e., millilitre, litre)]	***Teaching and Learning:*** Ask students how they chose the units for prompt C. Encourage discussion about different strategies. For example, students might predict whether masses are greater or less than 1 kg and use kilograms for those they think are greater than 1 kg and grams for those they estimate are less than 1 kg. Or, students might compare the objects to some whose mass they have already measured in this lesson, and use the same unit if they think the masses are close or a different unit if they think the masses differ.

Content	Expectations	Addressing Expectations
Lesson C: Comparing Masses, Supplement, p. 87	• estimate, measure, and record [length, perimeter, area,] mass, [capacity, volume, and elapsed time], using a variety of strategies • determine the relationships among units and measurable attributes, [including the area and perimeter of rectangles] – estimate, measure, and record the mass of objects, using the standard units of the kilogram and the gram – compare and order a collection of objects, using standard units of mass (i.e., gram, kilogram) [and/or capacity (i.e., millilitre, litre)] – select and justify the most appropriate standard unit to measure mass (i.e., milligram, gram, kilogram) [and the most appropriate standard unit to measure the capacity of a container (i.e., millilitre, litre)]	New Lesson
Lesson 7: Measuring Capacity, pp. 306–307	• estimate, measure, and record [length, perimeter, area, mass,] capacity, [volume, and elapsed time,] using a variety of strategies • determine the relationships among units and measurable attributes, [including the area and perimeter of rectangles] – estimate, measure, and record the capacity of containers, using the standard units of the litre and the millilitre – compare and order a collection of objects, using standard units of [mass (i.e., gram, kilogram) and/or] capacity (i.e., millilitre, litre) – determine, through investigation, the relationship between millilitres and litres	***Teaching and Learning:*** Since millilitre (mL) is a new unit in this lesson, begin with an introduction of millilitres. Focus attention on measurements in millilitres on containers students are using. Guide students to use some of these to fill a 1 L container. Discuss how this shows that the capacity 1 L equals 1000 mL. Have students order 5 of the containers from least to greatest capacity. Repeat this for a few groups of containers.
Lesson 8: Using Mass and Capacity, pp. 308–309	• determine the relationships among units and measurable attributes, [including the area and perimeter of rectangles] – select and justify the most appropriate standard unit to measure mass (i.e., milligram, gram, kilogram) and the most appropriate standard unit to measure the capacity of a container (i.e., millilitre, litre)	***Teaching and Learning:*** Include discussion about the unit *milligram.* Ask, "Why are chocolate chips measured in grams rather than milligrams?" ***Consolidation:*** Include a few questions about milligrams. **8.** Which unit would you use for each, milligram or gram? **a)** a grain of sand **b)** a pencil **c)** a small leaf **9.** What might you measure in milligrams? Why?
Lesson 9: Modelling Volume, pp. 310–311	• estimate, measure, and record [length, perimeter, area, mass, capacity,] volume, [and elapsed time,] using a variety of strategies – estimate, measure using concrete materials, and record volume, and relate volume to the space taken up by an object • construct three-dimensional figures, [using two-dimensional shapes] – construct a three-dimensional figure from a picture or model of the figure, using connecting cubes	***Teaching and Learning:*** Before students do prompt C, ask them to estimate the volume of models constructed by other pairs. Invite them to explain estimation strategies they used. Have pairs share the volumes they counted for prompt C with those who estimated. ***Consolidation:*** Tell students to estimate the volume of models created by classmates for Question 7. Then have them count to check their estimates.
Skills Bank: pp. 312–313		Optional
Problem Bank: pp. 314–315		Optional
Chapter Review: pp. 316–317		Assessment Opportunity
Chapter Review: Supplement, p. 89		New Assessment Opportunity
Chapter Task: Cube Creature, p. 318	• estimate, measure, and record [length, perimeter, area, mass, capacity,] volume, [and elapsed time], using a variety of strategies – estimate, measure using concrete materials, and record volume, and relate volume to the space taken up by an object • identify [quadrilaterals and] three-dimensional figures and classify them by their geometric properties, [and compare various angles to benchmarks] • construct three-dimensional figures, [using two-dimensional shapes] – identify and describe prisms and pyramids, and classify them by their geometric properties (i.e., shape of faces, number of edges, number of vertices), using concrete materials – construct a three-dimensional figure [from a picture or model of the figure], using connecting cubes	Assessment Opportunity
Chapters 8–11 Cumulative Review: pp. 319–320		Assessment Opportunity: Use Questions 1–2, 4–6, 8–9.

Chapter 12 Planning Chart: Fractions and Decimals

Content	Expectations	Addressing Expectations
Getting Started: Fractions, pp. 322–323		Beyond Grade 4 curriculum
Getting Started: Fractions, Supplement, p. 91		New Assessment Opportunity: Select notes from the Teacher's Resource for Getting Started: Fractions on pp. 322–323 of the Student Book to support the new Getting Started.
Lesson A: Fractions of a Set, Supplement, pp. 92–93	• read, represent,] compare, and order whole numbers to 10 000, decimal numbers to tenths, and] simple fractions,] and represent money amounts to $100] – represent fractions using concrete materials, words, and standard fractional notation, and explain the meaning of the denominator as the number of the fractional parts of [a whole or] a set, and the numerator as the number of fractional parts being considered	New Lesson
Lesson 1: Fractions of an Area, pp. 324–325	• read, represent, compare, and order [whole numbers to 10 000, decimal numbers to tenths, and] simple fractions, [and represent money amounts to $100] – represent fractions using concrete materials, words, and standard fractional notation, and explain the meaning of the denominator as the number of the fractional parts of a whole [or a set], and the numerator as the number of fractional parts being considered – compare and order fractions (i.e., halves, thirds, fourths, fifths, tenths) by considering [the size and] the number of fractional parts	***Teaching and Learning:*** When discussing Question 2, emphasize that the number of parts for $\frac{2}{3}$ is more than the number of parts for $\frac{1}{3}$, so $\frac{2}{3}$ is greater than $\frac{1}{3}$. ***Consolidation:*** Change the fraction in Question 3a) to $\frac{3}{10}$ and the fractions in Question 3d) to $\frac{3}{10}$ and $\frac{7}{10}$. For Questions 5a), b), and 6, extend the reasoning about why a fraction that represents more of the parts is greater than a fraction that represents fewer of the parts. Question 5, parts c) and d), goes beyond comparing fractions for halves, thirds, fourths, fifths, and tenths.
Lesson 2: Mixed Numbers and Improper Fractions, pp. 326–327		Beyond Grade 4 curriculum
Lesson 3: Fractions of a Set, pp. 328–329		Beyond Grade 4 curriculum
Lesson B: Comparing Fractions, Supplement, p. 95	• [read, represent,] compare, and order [whole numbers to 10 000, decimal numbers to tenths, and] simple fractions, [and represent money amounts to $100] – compare and order fractions (i.e., halves, thirds, fourths, fifths, tenths) by considering the size [and the number] of fractional parts	New Lesson
Lesson C: Equivalent Fractions, Supplement, pp. 97–98	• read, represent, compare, [and order whole numbers to 10 000, decimal numbers to tenths, and] simple fractions, [and represent money amounts to $100] – demonstrate and explain the relationship between equivalent fractions, using concrete materials and drawings – compare fractions to the benchmarks of 0, $\frac{1}{2}$, and 1	New Lesson
Lesson 4: Decimal Tenths, pp. 330–331	• read, represent, compare, and order [whole numbers to 10 000,] decimal numbers to tenths, [and simple fractions, and represent money amounts to $100] • demonstrate an understanding of proportional reasoning [by investigating whole-number unit rates] – demonstrate an understanding of place value in [whole numbers and] decimal numbers from 0.1 [to 10 000], using a variety of tools and strategies – determine and explain, through investigation, the relationship between fractions (i.e., [halves, fifths,] tenths) and decimals to tenths, using a variety of tools and strategies	***Teaching and Learning:*** Point out that the tenths digit is one place to the right of the ones digits. Tell students that the ones digits in 0.2 is 0 and the tenths digit is 2.
Lesson 5: Decimal Tenths Greater Than 1, pp. 332–333	• read, represent, compare, and order [whole numbers to 10 000,] decimal numbers to tenths, [and simple fractions, and represent money amounts to $100] – demonstrate an understanding of place value in [whole numbers and] decimal numbers from 0.1 [to 10 000], using a variety of tools and strategies – represent, compare, and order decimal numbers to tenths, using a variety of tools • determine the relationships among units and measurable attributes, [including the area and perimeter of rectangles] – describe, through investigation, the relationship between various units of length (i.e., [millimetre, centimetre,] decimetre, metre, [kilometre])	***Teaching and Learning:*** Discuss place value with students. For example, for 1.7 explain that the ones digit is 1 and the tenths digit is 7. Replace prompt C with the following: Why would the decimal for the jump distance of Josef's frog be 1 ■ m? Then continue with prompts D–F. Use Question 1. ***Consolidation:*** Ask students to name the ones digit and the tenths digit in various decimals in the questions. Use Questions 2a)–c), 3a)–b), 5–6.
Lesson D: Relating Fractions and Decimals, Supplement, p. 100	– determine and explain, through investigation, the relationship between fractions (i.e., halves, fifths, tenths) and decimals to tenths, using a variety of tools and strategies	New Lesson

Content	Expectations	Addressing Expectations
Lesson E: Counting Patterns, Supplement, pp. 102–103	• demonstrate an understanding of magnitude by counting forward and backwards by 0.1 and by fractional amounts – count forward by halves, thirds, fourths, and tenths to beyond one whole, using concrete materials and number lines – count forward by tenths from any decimal number expressed to one decimal place, using concrete materials and number lines • describe, extend, and create a variety of numeric [and geometric] patterns, [make predictions related to the patterns, and investigate repeating patterns involving reflections] – create a number pattern involving addition, [subtraction, or multiplication, given a pattern rule expressed in words]	New Lesson
Mid-Chapter Review: p. 334		Assessment Opportunity: Use Questions 1a), c) without the term *mixed number*, 2, 4a)–d).
Math Game: Find the Match, p. 335		Beyond Grade 4 curriculum
Lesson 6: Adding Decimal Tenths, pp. 336–337	• solve problems [involving the addition, subtraction, multiplication, and division of single- and multi-digit whole numbers, and] involving the addition [and subtraction] of decimal numbers to tenths [and money amounts, using a variety of strategies] – add [and subtract] decimal numbers to tenths, using concrete materials and student-generated algorithms • determine the relationships among units and measurable attributes, [including the area and perimeter of rectangles] – describe, through investigation, the relationship between various units of length (i.e., [millimetre, centimetre,] decimetre, metre, [kilometre])	
Lesson 7: Subtracting Decimal Tenths, pp. 338–339	• solve problems [involving the addition, subtraction, multiplication, and division of single- and multi-digit whole numbers, and] involving the [addition and] subtraction of decimal numbers to tenths [and money amounts, using a variety of strategies] – [add and] subtract decimal numbers to tenths, using concrete materials and student-generated algorithms • determine the relationships among units and measurable attributes, [including the area and perimeter of rectangles] – describe, through investigation, the relationship between various units of length (i.e., [millimetre, centimetre,] decimetre, metre, [kilometre])	
Lesson 8: Communicate About Decimal Operations, pp. 340–341	• solve problems [involving the addition, subtraction, multiplication, and division of single- and multi-digit whole numbers, and] involving the addition and subtraction of decimal numbers to tenths [and money amounts, using a variety of strategies] – add and subtract decimal numbers to tenths, using concrete materials and student-generated algorithms • determine the relationships among units and measurable attributes, [including the area and perimeter of rectangles] – describe, through investigation, the relationship between various units of length (i.e., [millimetre, centimetre,] decimetre, metre, [kilometre])	
Lesson 9: Decimal Hundredths Less Than or Equal to 1, pp. 342–343		Beyond Grade 4 curriculum
Lesson 10: Add and Subtract Hundredths, pp. 344–345		Beyond Grade 4 curriculum
Lesson 11: Relating Fractions and Decimals, p. 346		Beyond Grade 4 curriculum
Mental Math: Quarters and Dimes, p. 347	• solve problems [involving the addition, subtraction, multiplication, and division of single- and multi-digit whole numbers, and] involving the addition and subtraction of [decimal numbers to tenths and] money amounts, using a variety of strategies – add and subtract money amounts by making simulated purchases and providing change for amounts up to $100, using a variety of tools	
Skills Bank: pp. 348–350		Optional: Select from Questions 1, 2a), 8–18.
Skills Bank: Supplement, p. 105		Optional: New

Content	Expectations	Addressing Expectations
Problem Bank: p. 351		Optional: Select from Questions 2, 5–7.
Chapter Review: pp. 352–353		Assessment Opportunity: Use Questions 1, 4, 7–8.
Chapter Review: Supplement, p. 107		New Assessment Opportunity
Chapter Task: Decimal Kites, p. 353	• read, represent, [compare, and order whole numbers to 10 000,] decimal numbers to tenths, and simple fractions, [and represent money amounts to $100] – demonstrate an understanding of place value in [whole numbers and] decimal numbers from 0.1 [to 10 000], using a variety of tools and strategies – represent fractions using concrete materials, words, and standard fractional notation, [and explain the meaning of the denominator as the number of the fractional parts of a whole or a set, and the numerator as the number of fractional parts being considered]	Assessment Opportunity: Use kites 1 and 2 only

Chapter 13 Planning Chart: Probability

Content	Expectations	Addressing Expectations
Getting Started: What's Likely?, pp. 356–357		Assessment Opportunity
Lesson 1: Probability Lines, pp. 358–359	• predict [the results of a simple probability experiment, then conduct the experiment and compare the prediction to the results]	Use this lesson to develop a stronger ability to communicate using probability language.
Lesson 2: Experimenting with Spinners, pp. 360–361	• predict the results of a simple probability experiment, then conduct the experiment and compare the prediction to the results – predict the frequency of an outcome in a simple probability experiment, explaining their reasoning; conduct the experiment; and compare the result with the prediction – determine, through investigation, how the number of repetitions of a probability experiment can affect the conclusions drawn	***Teaching and Learning:*** After students conduct the experiment with spinners, have them combine results for the class. Pose questions about whether the combined results are different than results for each pair. Ask, "Are the results for the whole class closer to your prediction than your own results? What reasons can you give for this? How is combining results the same as repeating an experiment several times?" ***Consolidation:*** Have students combine results for Questions 3 and 4 to compare with their own results. Encourage discussion about comparing combined results with separate results.
Lesson 3: Making Predictions, pp. 362–363	• predict the results of a simple probability experiment, then conduct the experiment and compare the prediction to the results – predict the frequency of an outcome in a simple probability experiment, explaining their reasoning; conduct the experiment; and compare the result with the prediction – determine, through investigation, how the number of repetitions of a probability experiment can affect the conclusions drawn	***Teaching and Learning:*** After students complete the experiments, ask them to express their ideas about whether they think the results would vary if they repeated the experiments many times. Ask, "What do you notice about your results after drawing a tile the first few times in your experiments and after drawing a tile 20 times? What do you predict would happen if you drew a tile 40 times in one of your experiments?" Have students continue to draw tiles to compare with their predictions. Lead a discussion about what happened. Ask, "Do you think that when you increase the number of times you draw a tile, the result is closer to your prediction? Why or why not?"
Math Game: Predicting Tiles, p. 363		Optional
Mid-Chapter Review: p. 364		Assessment Opportunity
Math Game: Choose Your Spinner, p. 365		Optional
Lesson 4: Comparing Probabilities, pp. 366–367	• predict the results of a simple probability experiment, then conduct the experiment and compare the prediction to the results – predict the frequency of an outcome in a simple probability experiment, explaining their reasoning; conduct the experiment; and compare the result with the prediction – determine, through investigation, how the number of repetitions of a probability experiment can affect the conclusions drawn	***Teaching and Learning:*** Extend Question 1 by asking, "Why is it better to spin 50 times than to spin 5 times?" Encourage discussion about how the number of times an experiment is repeated affects the results.
Lesson 5: Creating Spinners, p. 368	• predict the results of a simple probability experiment, then conduct the experiment and compare the prediction to the results – predict the frequency of an outcome in a simple probability experiment, explaining their reasoning; conduct the experiment; and compare the result with the prediction – determine, through investigation, how the number of repetitions of a probability experiment can affect the conclusions drawn	***Teaching and Learning:*** When discussing experiments, ask, "Why do you think Part F said to test your spinner by spinning it 20 times instead of 1 time? What do you think would happen if you spun your spinner 100 times? Why do you think this? Do you think it would make a difference if you spun the spinner 1000 times? Explain your thinking."
Curious Math: Probability and Fractions, p. 369		Beyond Grade 4 curriculum
Lesson 6: Solve Problems Using Tree Diagrams, pp. 370–371		Beyond Grade 4 curriculum
Mental Imagery: Spinning Decimals, p. 372		Beyond Grade 4 curriculum
Skills Bank: pp. 373–374		Optional
Problem Bank: p. 375		Optional: Select from Questions 1–3.

Content	Expectations	Addressing Expectations
Chapter Review: pp. 376–377		Assessment Opportunity: Use Questions 1–6. Questions about how the number of times an experiment is repeated affects the results could be included.
Chapter Task: Probability Prizes, p. 378	• predict the results of a simple probability experiment, then conduct the experiment and compare the prediction to the results – predict the frequency of an outcome in a simple probability experiment, explaining their reasoning; conduct the experiment; and compare the result with the prediction – determine, through investigation, how the number of repetitions of a probability experiment can affect the conclusions drawn	Assessment Opportunity: Ask, "Why does Part D say to spin the spinner 40 times instead of 5 times or 10 times?"

Chapter 14 Planning Chart: Patterns and Motion in Geometry

Content	Expectations	Addressing Expectations
Getting Started: Identifying Geometric Patterns, pp. 380–381		Assessment Opportunity: Use prompts A–F, Questions 1, 3.
Lesson 1: Coordinate Grids, pp. 382–383	• identify and describe the location of an object, using a grid map, [and reflect two-dimensional shapes] – identify and describe the general location of an object using a grid system	The lesson relates grids to games.
Lesson 2: Translating Shapes, pp. 384–385		Beyond Grade 4 curriculum
Lesson 3: Rotating Shapes, pp. 386–387		Beyond Grade 4 curriculum
Lesson 4: Reflecting Shapes, pp. 388–389	• [identify and describe the location of an object, using a grid map, and] reflect two-dimensional shapes – identify, perform, and describe reflections using a variety of tools – create and analyse symmetrical designs by reflecting a shape, or shapes, using a variety of tools, and identify the congruent shapes in the designs	***Teaching and Learning:*** For Question 2, reinforce rotations from Grade 3 and from Getting Started. Address congruency in reflection designs by asking, "Which shapes in your design are congruent? How do you know? Why does this happen?" Elicit from students that all shapes that are created by a reflection are congruent to the shapes that are reflected. Discuss how the shapes are congruent although they are facing the opposite direction. Emphasize that being congruent depends on having the same shape and size, not on being in the same position or facing in the same direction.
Mid-Chapter Review: p. 390		Assessment Opportunity: Use Questions 1, 4.
Math Game: Grid Hide and Seek, p. 391		Optional
Lesson 5: Communicate About Transformations, pp. 392–393		Beyond Grade 4 curriculum
Lesson A: Reflection Patterns, Supplement, pp. 109–110	• describe, extend, and create a variety of [numeric and] geometric patterns, make predictions related to the patterns, and investigate repeating patterns involving reflections – make predictions related to repeating geometric [and numeric] patterns – extend and create repeating patterns that result from reflections, through investigation using a variety of tools • [identify and describe the location of an object, using a grid map, and] reflect two-dimensional shapes – identify, perform, and describe reflections using a variety of tools – create and analyse symmetrical designs by reflecting a shape, or shapes, using a variety of tools, and identify the congruent shapes in the designs	New Lesson
Lesson 6: Transformation Patterns, p. 394	• describe, extend, and create a variety of [numeric and] geometric patterns, make predictions related to the patterns, and investigate repeating patterns involving reflections – make predictions related to repeating geometric [and numeric] patterns – extend and create repeating patterns that result from reflections, through investigation using a variety of tools • [identify and describe the location of an object, using a grid map, and] reflect two-dimensional shapes – identify, perform, and describe reflections using a variety of tools – create and analyse symmetrical designs by reflecting a shape, or shapes, using a variety of tools, and identify the congruent shapes in the designs	***Teaching and Learning:*** Change Mandy's comments about her transformation pattern to say, "Then I made this pattern using reflections." Change prompt B as follows: B. Examine a trapezoid. "How could you use reflections to match the trapezoids in Mandy's pattern?" Adjust discussion in the Teacher's Resource to include reflections only. Emphasize that the trapezoids in Mandy's pattern are congruent. Discuss that this makes sense because the pattern was created by reflecting a trapezoid, keeping the shape and size of the trapezoid the same. Ask, "How can you make predictions to help you create Mandy's pattern?" Ensure that students use only reflections as they create their trapezoid patterns for Question 2. After they have completed the patterns, initiate a discussion about whether the trapezoids in their patterns are congruent. Encourage students to talk about their reasons.
Mental Imagery: Predicting Rotations, p. 395		Beyond Grade 4 curriculum

Content	Expectations	Addressing Expectations
Lesson 7: Extending Transformation Patterns, pp. 396–387		Beyond Grade 4 curriculum
Skills Bank: pp. 398–399		Optional: Select from Questions 1, 6–8. Adjust material in the Teacher's Resource for Questions 7 and 8 to talk only about reflections.
Problem Bank: pp. 400–401		Optional: Select from 1a)–c), 2b).
Chapter Review: pp. 402–403		Assessment Opportunity: Use Questions 1, 4, 7a). Question 8 can be used for the pattern in Question 7a) only.
Chapter Task: Making a Math Quilt, p. 404	• describe, extend, and create a variety of [numeric and] geometric patterns, [make predictions related to the patterns,] and investigate repeating patterns involving reflections – extend and create repeating patterns that result from reflections, through investigation using a variety of tools • [identify and describe the location of an object, using a grid map, and] reflect two-dimensional shapes – identify, perform, and describe reflections using a variety of tools – create and analyse symmetrical designs by reflecting a shape, or shapes, using a variety of tools, and identify the congruent shapes in the designs	Assessment Opportunity: The quilt pattern on p. 404 can be created with reflections, rotations, and translations. Tell students to use only reflections in their quilt patterns. Make adjustments as necessary to the Teacher's Resource so that only reflections are included. After the patterns are completed, ask students to identify congruent shapes in their patterns.
Chapters 12–14 Cumulative Review: pp. 405–406		Assessment Opportunity: Use Questions 3, 5, 7, 8a).

New Lessons

Teacher's Resource

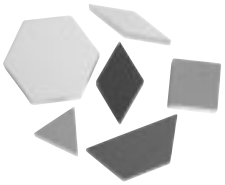
Mathematics 4
Ontario Supplement

CHAPTER 1

A Geometry Patterns

You will need

- pattern blocks



Goal **Describe geometry patterns and make predictions.**

Chris is making a pattern to decorate his classroom.

Chris's Pattern

I'll use hexagons and rhombuses for a repeating pattern. My pattern will start with a hexagon or a rhombus.

My pattern will go around the room from above the bulletin board to above the door.

I figured out that the 22nd shape will be above the door. I want it to be a hexagon.

? Which shape should be 1st in Chris's pattern?

A. Suppose Chris starts with a hexagon.
Predict the 13th shape.
Extend the pattern to check your prediction.

B. Suppose Chris starts with a rhombus.
Predict the 13th shape. Use pattern blocks to check.

C. Should Chris start his pattern with a hexagon or a rhombus for a hexagon to be above the door?

Reflecting

1. How did you decide which shape should be 1st in Chris's pattern?
2. How can you predict the 30th shape in Chris's pattern?

Checking

3. Mandy created this square and trapezoid pattern:

a) Describe Mandy's pattern.
b) Extend Mandy's pattern for the next 3 shapes.
c) Is the 14th shape the same as the 2nd or the 3rd shape? Why?
d) Predict the 24th shape. Explain.
e) Use pattern blocks to extend the pattern and check your prediction.

Practising

4. a) Vinh started his pattern with a trapezoid. Name the next 3 shapes in Vinh's pattern.

b) Predict the 25th and the 26th shapes. Explain.
c) Use pattern blocks to check your prediction.

5. a) Use pattern blocks to create your own pattern.
b) Describe your pattern.

A Geometry Patterns

Guided Activity

Materials	• pattern blocks
Masters	• (manipulatives substitute) Pattern Blocks, Masters Booklet, p. 38

Assessment for Feedback	What You Will See Students Doing…	
Students will	**When Students Understand**	**If Students Misunderstand**
• describe, extend, predict, and create geometric patterns	• Students will describe, extend, and predict patterns with shapes.	• If students have difficulty predicting, have them create patterns, make predictions, and then extend their patterns with pattern blocks to check.

1. Introduction (Whole Class/Pairs)

5–10 min

Present a pattern with 2 different pattern blocks. Discuss how to extend the pattern. Emphasize why it is necessary to show the repeating part, the core, at least 3 times to give enough information to extend the pattern. Have pairs create repeating patterns with any 2 pattern blocks. Invite pairs to show their patterns to the class, and ask how to extend them.

2. Teaching and Learning

(Whole Class/Pairs) 15–20 min

Discuss Chris's pattern at the top of Lesson 1A and how he will use the pattern. Read the central question. Guide pairs through prompt A, discussing vocabulary. Have pairs complete prompts B and C. Then discuss answers.

Reflecting Use these questions to ensure that students understand how to predict shapes and relate predictions to extending a pattern.

Sample Discourse

1. • *The pattern has 3 shapes that repeat, 1 hexagon and 2 rhombuses. The 1st shape in each group of 3 is the same. I can use the shapes to help me with the counting pattern 3, 6, 9, 12, 15, 18, 21. The 3 shapes repeat again starting with the 22nd shape, so the 22nd shape is the same as the 1st shape. The 1st shape should be a hexagon.*

2. • *I know from Part C that Chris's pattern has the core hexagon, rhombus, rhombus. It starts with a hexagon. The 22nd shape is a hexagon. The 23rd and 24th shapes are rhombuses, the 25th shape is a hexagon, the 26th and 27th shapes are rhombuses, the 28th shape is a hexagon, and the 29th and the 30th shapes are rhombuses. The 30th shape is a rhombus.*

3. Consolidation

20–30 min

Checking (Pairs)

3. If students need help with part d), guide them for skip counting by 2s for 2 squares and 2 trapezoids.

Practising (Individual)

4. Use Assessment Tool 6, Masters Booklet, p. 7, to assess answers for this key assessment question.

5. Make sure students repeat the core 3 times for part a).

Closing (Whole Class) Ask, "How did you predict shapes in patterns?" Encourage discussion about a variety of strategies. Include variations according to the number of shapes in the core.

Answers

A. hexagon; hexagon, rhombus, rhombus, hexagon, rhombus, rhombus, hexagon, rhombus, rhombus, hexagon, rhombus, rhombus, hexagon

B. rhombus; rhombus, rhombus, hexagon, rhombus, rhombus, hexagon, rhombus, rhombus, hexagon, rhombus, rhombus, hexagon, rhombus, or rhombus, hexagon, rhombus, rhombus, hexagon, rhombus, rhombus, hexagon, rhombus, rhombus, hexagon, rhombus, rhombus

C. hexagon

1.–2. See sample answers under Reflecting.

3. a) Start with square, square, trapezoid, trapezoid. Repeat these 4 shapes over and over.

b) square, square, trapezoid

c) 2nd; For example, the core is 4 shapes repeated: square, square, trapezoid, trapezoid. The picture of 12 shapes shows the core of 2 squares, 2 trapezoids repeated 3 times. So, the core starts again with the 13th shape. The next 2 shapes, the 13th and the 14th, are squares. So, the 14th shape is the same as the 2nd shape.

d) trapezoid; For example, the core is 2 squares, 2 trapezoids. I skip counted by 2s from the 1st 12 shapes: 14 for squares as the 13th and 14th shapes, 16 for trapezoids as the 15th and 16th shapes, 18 for squares as the 17th and 18th shapes, 20 for trapezoids, 22 for squares, 24 for trapezoids as the 23rd and 24th shapes.

e) Students should use 24 pattern blocks for 2 squares, and 2 trapezoids, repeated.

4. a) trapezoid, trapezoid, hexagon

b) hexagon, trapezoid; For example, the pattern is 5 shapes repeated. I skip counted by 5s because each group of 5 shapes has a trapezoid, a trapezoid, a trapezoid, a hexagon, and a hexagon: 5, 10, 15, 20, 25. So, the 25th shape is the last shape in the core, a hexagon. The 26th shape is the 1st shape in the core, a trapezoid.

(Lesson 1A Answers continued on Supplement, p. 113)

B Decreasing Patterns

Goal **Describe number patterns and make predictions.**

Chantal has 45 beads. She uses 7 beads to make each chain.
Rey has 36 beads. He uses 5 beads to make each chain.

? Who can make more chains?

Chantal's Decreasing Pattern

I'll use a table to show the patterns.

Term number	Number of chains	Term (number of beads left)
1	1	38
2	2	31

A. How could Chantal calculate the 1st term for the number of beads left?

B. Extend Chantal's pattern to complete the table.

C. Write a rule for the pattern in the 3rd column.

D. Predict the number of chains Rey can make.

E. Create a pattern like Chantal's to check your prediction in Part D.

F. Who can make more chains? How do you know?

term number
A number that tells the position of a term in a pattern
18, **16**, **14**, **12**, ...
1st term, 2nd term

term
Each number or item in a pattern

Reflecting

1. **a)** How did you know when you completed each table?
b) How did you predict for Part D?

2. Why is the number of chains a growing pattern, when the number of beads left is a shrinking pattern?

B Decreasing Patterns

Exploration

Materials	• (optional) counters
Masters	• (optional) Number Lines, Masters Booklet, p. 32

Assessment for Feedback	What You Will See Students Doing…	
Students will	**When Students Understand**	**If Students Misunderstand**
• describe decreasing number patterns and make predictions	• Students will be able to correctly describe decreasing patterns and make predictions.	• Students may have difficulty with decreasing number patterns. Have them use counters or skip count on number lines to model making the chains.

1. Introduction (Whole Class) ▸ 5–10 min

Write a pattern rule on the board. For example: Begin with 20. Increase each number by 8. Have students give the next 6 numbers. Ask, "Are the numbers in the pattern increasing or decreasing?" Repeat this with a decreasing pattern. Then ask, "How is a decreasing or shrinking pattern different from an increasing or growing pattern?" Elicit from students that for an increasing pattern, they add to get the next number. Contrast this with subtracting to get the next number in a shrinking pattern.

2. Teaching and Learning (Whole Class/Pairs) ▸ 25–35 min

Discuss the information at the top of Lesson 1B and the central question. Introduce the definitions for *term* and *term number*. Term and term number are also introduced in the planning chart for Lesson 3. Ask, "What is the first term for the number of beads left in Chantal's chart?" *(38)* "What is the term number for 31?" *(2nd term or term number 2)* Do prompt A with the class. Have pairs complete prompts B and C. Discuss the results as a class. Have the pairs do prompts D and E and then share their answers with the class.

Reflecting Here, students discuss how to extend, describe, and create decreasing patterns, and make predictions.

Sample Discourse

1. a) • *When I could not subtract the number of beads needed to make another chain, I knew I had completed a table.*

b) • *35 is close to 36. So, I skip counted backward by 5s from 35 and counted the number of numbers. I said: 35, 30, 25, 20, 15, 10, 5. That's 7 numbers, so, I predicted Rey can make about 7 chains.*

2. • *When they make a chain, the number of chains increases by 1, but the number of beads left decreases by the number of beads in each chain.*

3. Consolidation ▸ 10–15 min

Closing (Whole Class) Present a pattern on the board, such as 2, 4, 6, 8. Ask, "Is this an increasing or a decreasing pattern? How do you know?" Have students extend the pattern. Ask them to predict the 12th term. Invite students to discuss their strategies. Have them create a decreasing pattern starting with a number close to 50. Name a term for students to predict. Ask, "What did you do differently from predicting for an increasing pattern?"

Answers

A. For example, she could subtract the number of beads in each chain, 7, from the number of beads she has, 45.

B.

Term number	Number of chains	Term (number of beads left)
1	1	38
2	2	31
3	3	24
4	4	17
5	5	10
6	6	3

C. Start at 38 and subtract 7 each time.

D. For example, about 7

E.

Term number	Number of chains	Term (number of beads left)
1	1	31
2	2	26
3	3	21
4	4	16
5	5	11
6	6	6
7	7	1

F. Rey; For example, he can make 7 chains, which is more than Chantal's 6.

1.–2. See sample answers under Reflecting.

Chapter Review

LESSON

A

1. **a)** Terry is making this pattern. Describe Terry's pattern.

b) Use a picture or words to show the next 4 shapes.
c) Predict the 24th and the 25th shapes. Explain.
d) Extend the pattern to check your predictions.

2. Miki made a row with 5 different shapes.
She created a pattern by repeating the 5 shapes over and over.
Which shape or shapes are the same as the 2nd shape? Why?
A. 20th **B.** 21st **C.** 22nd **D.** 23rd **E.** 24th

B

3. Calvin has 37 feathers. He uses 6 feathers to make each dreamcatcher.
a) Complete this table. How many dreamcatchers can he make?
b) What is the 2nd term for the number of feathers left?
c) Write a rule for the pattern in the 3rd column.

Term number	Number of dreamcatchers	Term (number of feathers left)
1	1	31
2	2	25

4. Zola wrote this pattern:
52, 46, 40, 34, 28, 22, ...
a) What is the term number for the term 46?
b) What is the 8th term in Zola's pattern?
c) Is the pattern in the 3rd column a repeating, growing, or shrinking pattern? Explain.

5. Create the pattern for each rule. Write the next 5 terms.
a) Start at 35. Subtract 7 from each term to get the next term.
b) Start at 43. Subtract 4 from each term to get the next term.

6. Predict the 10th term in this pattern: 60, 58, 56, 54, ...
Explain how you predicted.

Chapter Review Lessons A and B

Using the Chapter Review

Materials	• pattern blocks
Masters	• (manipulatives substitute) Pattern Block Shapes, Masters Booklet, p. 38

Use this supplemental review to assess students' understanding of the concepts developed in Lessons 1A and 1B. All questions can be used for summative assessment.

1. Students may find it helpful to model the next 4 shapes using pattern blocks before answering the question.
2. Point out that the pattern can be any 5 different shapes. Students can model the pattern using any 5 different pattern blocks as the core and repeating the same pattern blocks.
3. Emphasize that the 1st term is 31, which is the number of feathers Calvin has after using 6 of his 37 feathers to make the 1st dreamcatcher.

Related Questions to Ask

Ask	Possible Response
About **Question 3**:	
• How does skip counting backward help?	• *When I count backward from 31, I can count how many dreamcatchers Calvin can make.*
• How can you skip count forward to check the answer?	• *I can skip count forward by 6 starting with the last number in the 3rd column, which is 1, for 1, 7, 13, 19, 25, 31. That's 6 numbers. So, Calvin can make 6 dreamcatchers.*
About **Question 5**:	
• Can there be more than one pattern for each part of this question?	• *No, there can be only one pattern because the pattern rule tells both the starting number and the change that happens from term to term.*

Answers

1. a) Start with a triangle, a triangle, a square, and a square. Repeat these 4 shapes over and over.

b) triangle, square, square, triangle

c) square, triangle; For example, the pattern has 4 shapes that repeat over and over. I can skip count by 2s for triangles, then squares: 2 for triangles, 4 for squares, 6 for triangles, 8 for squares, 10 for triangles, 12 for squares, 14 for triangles, 16 for squares, 18 for triangles, 20 for squares, 22 for triangles, 24 for squares. So, the 24th shape is the last shape in the core, a square, and the 25th shape is the 1st shape in the core, a triangle.

d) Students use pattern blocks to show triangle, triangle, square, square, triangle, triangle, square, square, triangle, triangle, square, square, triangle, triangle, square, square, triangle, triangle, square, square, triangle, triangle, square, square, triangle.

2. C; For example, count by 5s for 5, 10, 15, 20. So, the 20th shape is the same as the last shape in the core. The 21st shape is the same as the 1st shape in the core of 5 shapes. The 22nd shape is the same as the 2nd shape in the core. The 23rd shape is the same as the 3rd shape. The 24th shape is the same as the 4th shape.

3. a) 6

Term number	Number of dreamcatchers	Term (number of feathers left)
1	1	31
2	2	25
3	3	19
4	4	13
5	5	7
6	6	1

b) 25

c) Start at 31 and subtract 6 each time.

4. a) 2

b) 10

c) shrinking pattern; For example, each term is less than the one before it.

5. a) 28, 21, 14, 7, 0

b) 39, 35, 31, 27, 23

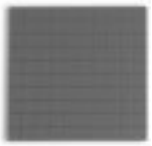
6. 42; For example, I counted backward by 2s from 60 for 60, 58, 56, 54, 52, 50, 48, 46, 44, 42. So, the 10th term is 42.

CHAPTER 2

A Dividing by 10 and 100

You will need

- base ten blocks



Goal **Divide by 10 and 100.**

Zola will send 100 of each kind of her flyers to a different store. Vinh will send 10 of each kind of his flyers to a different mall.

Zola's flyers	Vinh's flyers
700 for a concert	300 for an arena
1100 for a movie	980 for a park
2000 for a game	4000 for a sale

? How many stores and how many malls will get flyers?

A. Model 700 concert flyers with hundreds blocks.
Each hundreds block models the number of concert flyers for each store.
How many hundreds blocks are there?
Complete 700 ÷ 100 = ■.

B. How many stores will get Zola's concert flyers?

C. Repeat Parts A and B for Zola's other flyers.

D. How many tens blocks equal 300?
Each tens block models the number of arena flyers for each mall.
How many tens blocks would there be?
Complete 300 ÷ 10 = ■.

E. How many malls will get Vinh's arena flyers?

F. Repeat Parts D and E for Vinh's other flyers.

Reflecting

1. Describe rules for dividing by 10 and by 100.

2. Explain how to use your division strategies.

a) 500 ÷ 10 **c)** 790 ÷ 10

b) 6000 ÷ 100 **d)** 8200 ÷ 100

A Dividing by 10 and 100

Exploration

Materials	• base ten blocks (hundreds) • (optional) base ten blocks (tens) • (optional) calculators
Masters	• (manipulatives substitute) Base Ten Blocks: Hundreds, Tens, Masters Booklet, pp. 34–35

Assessment for Feedback	What You Will See Students Doing…	
Students will	**When Students Understand**	**If Students Misunderstand**
• divide by 10 and 100	• Students will be able to correctly divide by 10 and 100 using or describing base ten blocks.	• Students who need more examples for the patterns can use calculators to divide by 10 and discover the pattern. They can do the same for dividing by 100. Discuss how the patterns are the same and how they are different.

1. Introduction (Whole Class) ▸ 5–10 min

Pose a problem for the class, saying, "Suppose you saw 1200 butterflies in the Butterfly Conservatory in Niagara Falls. How can you model 1200 using only 1 type of base ten block?" Guide students to model 1200 with hundreds. Ask, "How many hundreds blocks are there?" (*12*) Discuss how the hundreds blocks show that there are 10 tens in each hundred. Have students count by 10s to show that 1200 could be modelled as 120 tens. Discuss how the hundreds blocks show that there are 100 ones in each block. So, they could model 1200 as 1200 ones. Ask, "Could you model 1200 with just thousands? Why not?" Use a similar procedure for 750 butterflies. (*75 tens, 750 ones*)

2. Teaching and Learning (Whole Class/Pairs) ▸ 25–35 min

Direct students' attention to Lesson 2A. Ensure that students understand how the chart shows that Zola has 700 flyers for a concert, 1100 for a movie, and 2000 for a game. Point out that Zola will send 100 of each to a different store, that is, 100 concert flyers to each store, 100 movie flyers to each store, and 100 game flyers to each store. Ask students to explain how Vinh is sending his flyers to malls.

Read the central question. Guide students as they work in pairs for prompts A and B, using hundreds blocks to model dividing 700 into groups of 100. Have the pairs continue for prompt C and then discuss their answers.

Lead students through prompts D and E, discussing how tens blocks could be used to model dividing 300 into groups of 10. Demonstrate this for the class with 30 tens blocks. Have the pairs complete prompt F and then share their answers. Ask, "When did you talk about tens blocks?" (*to divide by 10*) "When did you use hundreds blocks?" (*to divide by 100*)

Reflecting Use these questions to lead students to express their thoughts about dividing by 100 and by 10.

Sample Discourse

1. • *When I divide a number by 10, the 0 in the ones place is gone. The other digits move 1 place to the right. When I divide a number by 100, the 0s in the ones and in the tens places are gone. The other digits move 2 places to the right.*

• *When I divide a number by 10, it's as if I traded thousands blocks for hundreds blocks, hundreds blocks for tens blocks, and tens blocks for ones blocks. When I divide a number by 100, it's as if I traded thousands blocks for tens blocks and hundreds blocks for ones blocks.*

2. a) • *Move each digit 1 place to the right and leave off the 0 at the right. Move the 5 hundreds to the tens place and the 0 tens to the ones place to get 50.*

b) • *Move each digit 2 places to the right and leave off the two 0s at the right. Move the 6 thousands to the tens place and the 0 hundreds to the ones place to get 60.*

c) • *Move the 7 hundreds to the tens place and the 9 tens to the ones place to get 79.*

d) • *Move the 8 thousands to the tens place and the 2 hundreds to the ones place to get 82.*

3. Consolidation ▸ 10–15 min

Closing (Whole Class) Ask, "How is 2000 ÷ 10 the same as finding the number of tens in 2 thousands?" Ask the class to divide 800 by 100. Write 800 ÷ 100 = 8 on the board. Then have them divide 800 by 10. Record 800 ÷ 10 = 80. Tell them to divide the answer 80 by 10. Record 80 ÷ 10 = 8. Ask, "How are these 2 methods the same? How are they different?" Lead students to realize that dividing by 100 is the same as dividing by 10 twice.

Answers

A. 7; 700 ÷ 100 = 7

B. 7

C. movie flyers: 11; 1100 ÷ 100 = 11
game flyers: 20; 2000 ÷ 100 = 20

D. 30; 300 ÷ 10 = 30

E. 30

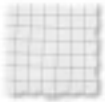
F. park flyers: 98; 980 ÷ 10 = 98
sale flyers: 400; 4000 ÷ 10 = 400

1.–2. See sample answers under Reflecting.

CHAPTER 3

A Comparing Stem-and-Leaf Plots

You will need

- stem-and-leaf plots from Curious Math: Stem-and-Leaf Plots
- elastics 
- a clock 
- grid paper 

Goal **Use stem-and-leaf plots to compare sets of data.**

Each student in Natalie's class made a chain by linking paper clips together for 2 minutes.
Then each student made another chain by tying elastics together for 2 minutes.

? How can you compare the number of links in paper-clip chains and elastic chains?

Natalie's Stem-and-Leaf Plots

I made a stem-and-leaf plot to show the number of paper clips in each chain.

Stem	Leaves for paper-clip chains
4	0 2
3	1 2 2 6 6 9 9
2	0 1 1 2 5 5 7 8 9
1	3 3 3 5 7 8 9 9

I made another stem-and-leaf plot to show the number of elastics in each chain.

Stem	Leaves for elastic chains
2	0 0 0 1 1 1 1 1 2 2 3 3 3 4 4 5 5
1	5 6 6 7 8 8 8 9 9

A. How are the ranges for Natalie's stem-and-leaf plots different?

B. Tie elastics together to make a chain while your partner times 2 minutes. Count the number of elastics.
Trade roles with your partner for another chain.

C. Make a chart that shows all of the class's elastic chains.

D. Make a stem-and-leaf plot to show the number of elastics in your class's chains.

E. How is your stem-and-leaf plot for elastic chains different from your stem-and-leaf plot for paper-clip chains from Curious Math: Stem-and-Leaf Plots? What does this show?

Reflecting

1. a) Why do you think it's useful to order the leaves?
b) Why is it important to line up the leaves?

2. a) Suppose Pedro tied 9 elastics in a chain. How could you use the stem 0 to show his data?
b) Suppose Zola linked 126 paper clips in a chain. How could you use the stem 12 to show her data?

3. How do stem-and-leaf plots help you compare sets of data?

Checking

4. This chart shows the number of links in chains students made in 5 minutes.

a) Make a stem-and-leaf plot for each set of data.
b) Which stem-and-leaf plot has more spread out values? What does this show?
c) Which kind of chain do you think is faster to make? Explain.

Number of paper clips		Number of elastics	
96	115	83	120
149	137	105	89
120	162	118	108
134	101	100	92
148	151	119	105
126	119	114	122
84	104	123	110

Practising

5. This chart shows the number of paper clips students in 2 classes hung from a big paper clip in 2 minutes.

a) Make a stem-and-leaf plot for each class.
b) What do the stem-and-leaf plots show about how the 2 sets of data are the same?
c) How are the 2 sets of data different?

Sarah's class	26	29	29	22	24	16
	18	30	30	16	24	20
	21	19	26	29	30	24
Jon's class	25	30	18	36	31	21
	35	27	19	19	25	28
	36	24	34	32	28	28

A Comparing Stem-and-Leaf Plots

Guided Activity

Materials	• stem-and-leaf plots from Curious Math: Stem-and-Leaf Plots, Student Book, p. 65 • elastics • a clock
Masters	• 1 cm Grid Paper, Masters Booklet, p. 23

Assessment for Feedback	What You Will See Students Doing…	
Students will	**When Students Understand**	**If Students Misunderstand**
• use stem-and-leaf plots to compare 2 sets of data	• Students will be able to correctly use stem-and-leaf plots to compare 2 sets of data.	• Students may not understand that the leaf shows the last digit of the number and the stem shows the other digits. Suggest that students underline the last digit in each number to help them see the leaves.

1. Introduction (Whole Class) ▸ 5–10 min

Demonstrate tying elastics together to create a chain as in the photograph of Lesson 3A. Have students practise making elastic chains. Then ask, "How many elastics do you think you can tie together in 2 minutes? Do you think it will be about the same as paper clips or different? Why do you think this?"

2. Teaching and Learning (Whole Class/Pairs) ▸ 15–20 min

Read the information at the top of Lesson 3A and the central question. Ask, "How are Natalie's stem-and-leaf plots the same? How are they different?" Elicit from the students that both have the same number of leaves, but the stem-and-leaf plot for paper-clip chains has 4 stems, and the one for elastic chains has 2 stems. Ask, "How many students made the elastic chains? How many students had 22 elastics in their chains? How do you know?" Remind students that there are no commas between leaves. Point out that leaves are lined up one under the other so that the number of leaves can be compared by looking at the length of each row. Have students do prompts A and B in pairs. Do prompt C as a class. Have students do prompt D in pairs. Discuss prompt E as a class.

Reflecting These questions lead students to discuss using stem-and-leaf plots to compare sets of data.

Sample Discourse

1. a) • *When the leaves are recorded from least to greatest, I can quickly see if any numbers are repeated. It shows if the leaves for a stem are spread out or close together.*

b) • *It makes it easier to compare the number of leaves for the stems.*

2. a) • *Write the stem 0 in order with the other stems. Write the leaf 9 to the right of the stem, going from least to greatest with any other leaves for the stem 0.*

Stem	Leaves
0	9

b) • *Write the stem 12 in order with the other stems. Write the leaf 6 to the right of the stem, going from least to greatest with any other leaves for the stem 12.*

Stem	Leaves
12	6

3. • *I can compare the stems and see which set of data has greater values and which has more stems. I can see at a glance which stem or stems have more leaves. That shows whether there are several values close together.*

3. Consolidation ▸ 20–30 min

Checking (Pairs)

4. Emphasize that the leaves must be lined up. Provide grid paper to help students.

Practising (Individual)

5. Use Assessment Tool 8, Masters Booklet, p. 9, to assess answers for this key assessment question.

Closing (Whole Class) Ask, "Why do you think this type of data display is called a stem-and-leaf plot? What might you display in one? Why?" To help students, suggest examples such as the number of pages students read during silent reading time or sports scores over a season.

Answers

A. The range of the numbers for elastic chains is 10. It is much less than the range for paper-clip chains, which is 29.

B. For example, 14, 23

C. For example,

Number of elastics
11 12 13 13 13 14 14 15 15
16 17 17 18 18 19 19 20 21
21 21 21 21 21 21 22 22 22
23 23 24 25 26

D. For example,

Stem	Leaves for elastic chains
2	0 1 1 1 1 1 1 1 2 2 2 3 3 4 5 6
1	1 2 3 3 3 4 4 5 5 6 7 7 8 8 9 9

E. For example, the range is less for elastic chains than for paper-clip chains. More values are repeated for elastic chains than for paper-clip chains. This shows the data for paper-clip chains are more spread out. So, the number of links in our paper-clip chains varied more than for our elastic chains.

1.–3. See sample answers under Reflecting.

(Lesson 3A Answers continued on Supplement, p. 113)

B Constructing a Double Bar Graph

Goal **Use double bar graphs to compare sets of data.**

Rami made this chart with data for some students' paper-clip chains and elastic chains.

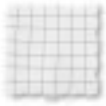
Chains We Made in 2 Minutes

Student	Number of paper clips	Number of elastics
Rami	23	19
Mandy	28	22
Allison	19	17
Rey	35	22

? How can you use a graph to compare the chains?

You will need

- data for paper-clip chains from Lesson 3
- data for elastic chains from Lesson A
- grid paper



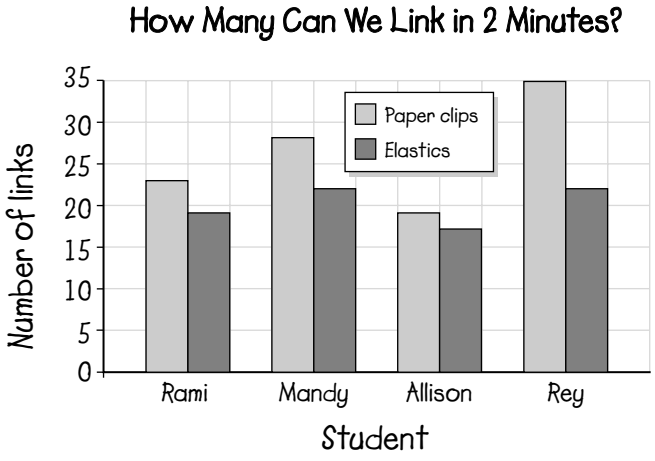
- pencil crayons

double bar graph
A bar graph with double bars to compare 2 sets of data

Rami's Double Bar Graph

I made a **double bar graph**.
I drew a bar for the number of links in each chain.
I coloured each bar a different colour and drew a box to show what each colour represents.

I used the same 2 colours to draw double bars for each student.



The difference between the heights of the bars is greatest for Rey. That shows that the difference between the number of links in his chains is greatest.

For each student, the bar for paper clips is higher than the bar for elastics. Each student has more paper-clip links than elastic links.

Reflecting

1. **a)** Why did Rami need to show what each colour represents?
   b) Why do you need to use both sets of data to choose a scale for a double bar graph?
2. How is Rami's double bar graph like 2 bar graphs?
3. What is an advantage of using a double bar graph instead of bar graphs you used in other lessons?

Checking

4. This chart shows the number of chains Carmen's class made last week.
   a) Make a double bar graph for the data.
   b) Explain how you chose the scale for the axis that shows the number of chains.
   c) Did they make more paper-clip or elastic chains on Monday? Is this true for each day? How does your graph show this?

Number of Chains

Day	Paper-clip chains	Elastic chains
Monday	14	25
Wednesday	9	16
Friday	31	18

Practising

5. **a)** Make a chart like Rami's with the number of paper clips and the number of elastics in your chains and in chains for 4 or 5 other students.
   b) Make a double bar graph for your chart.
   c) Which of the chains has more links? Explain.
   d) Whose chains have numbers of links that are closest together? Explain.

B Constructing a Double Bar Graph

Direct Instruction

Materials	• data for paper-clip chains from Lesson 3 • data for elastic chains from Lesson A • pencil crayons
Masters	• 1 cm Grid Paper, Masters Booklet, p. 23

Assessment for Feedback	What You Will See Students Doing…	
Students will	**When Students Understand**	**If Students Misunderstand**
• use double bar graphs to compare 2 sets of data	• Students will be able to correctly use double bar graphs to compare 2 sets of data.	• Students may not understand how to choose appropriate intervals for 2 sets of data. Help them compare the sets. Suggest that they round the highest value to one that they can easily skip count to.

1. Introduction (Whole Class) ▸ 5–10 min

Ask how the stem-and-leaf plots in Lesson 3A were useful for comparing data. Say, "Suppose you wanted to compare the paper-clip chain data and the elastic chain data in a bar graph."

2. Teaching and Learning (Whole Class/Pairs) ▸ 15–20 min

Discuss the definition of a *double bar graph* in Lesson 3B with the students. Read the central question together. Ask, "What did Rami do first to draw his graph? What did he do next?" As a class, construct the graph, step-by-step, on the board or using an overhead projector. Remind students that the scale must fit both sets of data. Ask, "Why is Rami's graph called a double bar graph? If he put each set of data in a separate graph, how would they look?"

Reflecting These questions lead students to discuss how to construct double bar graphs for comparing sets of data.

Sample Discourse

1. a) • *If Rami did not use colour to show what each bar represents, you would not know which bars tell about paper-clip chains and which tell about elastic chains.*

b) • *The scale needs to let you draw the bars for both sets of data on the same graph.*

2. • *The bars for paper-clip chains could be shown in one bar graph, and the bars for elastic chains could be shown in another bar graph. The double bar graph shows the data for both chains together instead of using 2 bar graphs.*

3. • *A double bar graph helps you compare data in one set, such as the number of links in paper-clip chains, with data in another set, such as the number of links in elastic chains. Bar graphs in other lessons compared data in only one set, such as the number of links in different elastic chains.*

3. Consolidation ▸ 20–30 min

Checking (Pairs)

4. Remind students that the scale must fit both sets of data. Ask students which intervals might work here.

Practising (Individual)

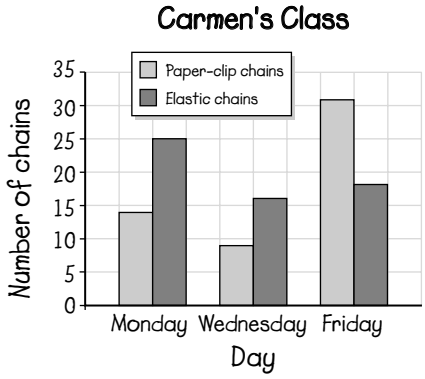
5. Use Assessment Tool 8, Masters Booklet, p. 9, to assess answers for this key assessment question.

Closing (Whole Class) Ask, "How do double bar graphs help you make comparisons?"

Answers

1.–3. See sample answers under Reflecting.

4. a)



b) For example, the greatest value in the set of data is a little greater than 30. I can skip count by 5s to 30. So, I used a scale of 5.

c) elastic chains; It is the same for Wednesday. On Friday; they made more paper-clip chains.

5. a) For example,

Student	Number of paper clips	Number of elastics
Donna	25	17
Greg	26	20
Tamara	18	15
Ryan	34	21
Jim	35	22

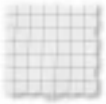
(Lesson 3B Answers continued on Supplement, p. 113)

CHAPTER 3

C Median and Mode

You will need

- grid paper



Goal **Use median and mode to compare sets of data.**

Shani and Calvin read this chart at a conservation area.

How Long Are the Snakes We've Seen This Year?

Eastern Garter Snakes (centimetres)
56 67 54 48 55 62 59 62 70 51 54
Eastern Milk Snakes (centimetres)
64 82 51 90 75 83 56 69 77 88

? Which kind of snake is usually longer?

Shani's Solution

I'll look for the length that happens most for each kind of snake.

The length that happens most is called the **mode**.

Calvin's Solution

I'll compare a middle-sized Eastern Garter Snake with a middle-sized Eastern Milk Snake.

I can order the lengths for each kind of snake from least to greatest to help me find the middle length for each.

The middle value is called the **median**.

A. Complete Shani's solution.

B. Complete Calvin's solution. Does the median for Eastern Milk Snakes describe the lengths well? Why?

C. Which kind of snake do you think is usually longer?

mode

The number that happens most often in a set of numbers

3, 5, 2, 7, 2
The mode is 2.

median

The middle number when a set of numbers is ordered from least to greatest, or the number that is halfway between the 2 middle numbers

2, 4, 6, 7
The median is 5. It is halfway between 4 and 6.

Reflecting

1. In Part A, one set of data has 2 modes, and the other set does not have a mode. Explain.
2. In Part B, how did you calculate the median for Eastern Milk Snakes?
3. Explain your thinking for Part C.

Checking

4. Each set is the number of snakes that visitors to a conservation area saw. Does each set have a mode? If so, write the mode or modes.
   a) 6, 4, 3, 2, 4, 4 **b)** 2, 1, 0, 2, 0, 2, 0 **c)** 4, 2, 6, 1, 5
5. Each set is the number of frogs that visitors saw. What is the median for each set?
   a) 6, 3, 2, 4, 5 **b)** 7, 4, 2, 0 **c)** 5, 2, 4, 4, 1

Practising

We measured lengths of Five-lined Skinks in centimetres.

19 15 15 17 16
15 19 20 18

6. This list shows lengths of Five-lined Skinks. What are the mode and median of the lengths?
7. This chart shows the number of people who watched each movie at a conservation area.
   a) Make a stem-and-leaf plot for the data.
   b) What is the mode for each movie?
   c) What is the median for each movie?
   d) How can a stem-and-leaf plot help you determine the mode and the median?
   e) Which movie was more popular? Explain your reasoning.

Attendance at Movies Last Weekend

Favourite Snakes	18 12 34 24 22 20 27 29 8 11 8 27
A Day in the Life of a Frog	23 24 33 19 26 17 16 28 17 12 9 5

8. Create 2 sets of data where the median of one set is the same as the median of the other set.

C Median and Mode

Guided Activity

Masters	• 1 cm Grid Paper, Masters Booklet, p. 23

Assessment for Feedback	What You Will See Students Doing…	
Students will	**When Students Understand**	**If Students Misunderstand**
• use median and mode to compare 2 sets of data	• Students will be able to correctly use median and mode to compare 2 sets of data.	• Students may need assistance in ordering a set of data from least to greatest. They might use a number line or metre stick to determine the median.

1. Introduction (Whole Class) ▸ 5–10 min

Record these scores for games on the board: 6, 8, 9, 3, 1, 8. Explain that these are the numbers of points a team scored in recent games. Or use scores that are relevant to the class. Ask, "What do you estimate is the usual score?" Encourage discussion about different ways to answer the question.

2. Teaching and Learning (Whole Class/Pairs) ▸ 15–20 min

Read the information at the top of Lesson 3C and the central question together. In pairs, have students complete prompts A to C. Remind students that both medians and modes can be used for prompt C.

Reflecting These questions lead students to discuss using median and mode to compare 2 sets of data.

Sample Discourse

1. • *Two lengths for the Eastern Garter Snakes happened twice, so each of these lengths is a mode. The lengths for the Eastern Milk Snakes are all different. Since no length happens more than any other, there is no mode.*

2. • *The 2 middle lengths are 75 cm and 77 cm. I know that 76 cm is halfway between these lengths.*

3. • *The median for the Eastern Milk Snakes is 76 cm. That is quite a bit greater than the median for the Eastern Garter Snakes, which is 56 cm. The modes for the Eastern Garter Snakes are 62 cm and 54 cm. These are close to the median for these snakes and lower than most lengths of the Eastern Milk Snakes.*

3. Consolidation ▸ 20–30 min

Checking (Pairs)

4.–5. Students may find it helpful to write the numbers in order from least to greatest.

Practising (Individual)

7. Use Assessment Tool 9, Masters Booklet, p. 10, to assess answers for this key assessment question.

Closing (Whole Class) Use examples of data, such as the number of students who played outside each day in a week or the number of pages in different books. Ask, "What are the mode and the median? How well do they describe the data? How can you use the median to compare 2 sets of data?"

Answers

A. Eastern Garter Snakes: 54 cm and 62 cm; Eastern Milk Snakes: no mode

B. Eastern Garter Snakes: 56 cm; Eastern Milk Snakes: 76 cm; For example, yes, because the modes and many lengths are close to it.

C. For example, Eastern Milk Snakes

1.–3. See sample answers under Reflecting.

4. **a)** 4 **b)** 0, 2 **c)** none

5. **a)** 4 **b)** 3 **c)** 4

6. mode: 15; median: 17

7. **a)**

Stem	Leaves for *Favourite Snakes*
3	4
2	0 2 4 7 7 9
1	1 2 8
0	8 8

Stem	Leaves for *A Day in the Life of a Frog*
3	3
2	3 4 6 8
1	2 6 7 7 9
0	5 9

b) *Favourite Snakes*: 8, 27; *A Day in the Life of a Frog*: 17

c) *Favourite Snakes*: 21; *A Day in the Life of a Frog*: 18

d) For example, a stem-and-leaf plot shows data from least to greatest. I can mark the greatest and least values until I get to the middle, or count to find the median. I can count the number of times values happen to determine the mode.

e) *Favourite Snakes*; For example, mode and median are both higher than for the other movie.

8. For example, attendance at sports events

hockey: 20 24 25 28 30; baseball: 19 23 25 26 31

The median for both is 25.

Chapter Review

LESSON

A

1. This chart shows the number of times several students spun each colour on a spinner in a game.

a) Make a stem-and-leaf plot for each colour.

b) Do you think more of the spinner is red or blue? Why do you think this?

c) Does the chart or the stem-and-leaf plot show the data better? Explain.

Number of Times for Each Colour

Blue	Red
115 95	136 132
118 120	150 143
96 101	133 135
117 105	131 128
94 122	136 140
109 98	127 142

B

2. This chart shows the number of students who played basketball or baseball at school.

a) Make a double bar graph for the data.

b) On which day did the number of students who played each game differ the most? How does your graph show this?

Number of Students

Day	Basketball	Baseball
Wednesday	15	9
Thursday	17	21
Friday	25	17

3. Paulette conducted a survey for choosing a school song. This chart shows her data.

a) Make a double bar graph for the data.

b) Josef drew a different bar graph to show the data for each song. What does your double bar graph show that Josef's graphs would not show?

Number of Students

Grade	*Animal Surprise*	*Stars, Stars*
2	33	14
3	28	21
4	26	26
5	10	39

C

4. Manitok researched the high temperature in degrees Celsius for the 1st week in May last year.

a) What is the median high temperature for each city?

b) What is the mode high temperature for each city?

c) Which city was warmer during that week? Explain.

High Temperatures Last May

Collingwood (°C)	10 5 5 8 13 12 12
Windsor (°C)	13 10 7 14 15 20 19

5. Create a set of data for each description.

a) The median is 5°C.

b) There is no mode.

c) There are 3 modes.

d) The median and mode are the same.

Chapter Review Lessons A, B, and C

Using the Chapter Review

Masters	• 1 cm Grid Paper, Masters Booklet, p. 23

Use this supplemental review to assess students' understanding of the concepts developed in Lessons 3A, 3B, and 3C. All questions can be used for summative assessment.

1. Have students who are experiencing difficulty organize the data from least to greatest before they make the stem-and-leaf plot.

3. Discuss the advantages of using a double bar graph instead of a single bar graph.

5. If students need help with part d), suggest that they start by choosing a number to be the median and the mode, and then writing data so that the number of data greater and less than the median is equal. They need to make sure that at least one number is the same as the number they decided to use as the mode.

Related Questions to Ask

Ask	Possible Response
About **Question 2**: • How could someone use your double bar graph to compare data?	• *It could be used to decide which sports the school should offer.* • *It could be used to determine how much equipment is needed in the school for these sports.*
About **Question 5**: • How are median and mode different?	• *Mode is the number that happens most often in a set of numbers.* • *Median is the middle number when a set of numbers is ordered from least to greatest, or the number that is halfway between the 2 middle numbers.*

Answers

1. a)

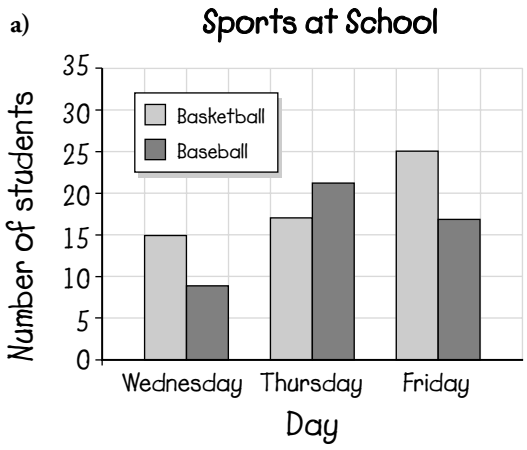
Stem	Leaves for blue
12	0 2
11	5 7 8
10	1 5 9
9	4 5 6 8

Stem	Leaves for red
15	0
14	0 2 3
13	1 2 3 5 6 6
12	7 8

b) red; For example, they spun red much more often than blue.

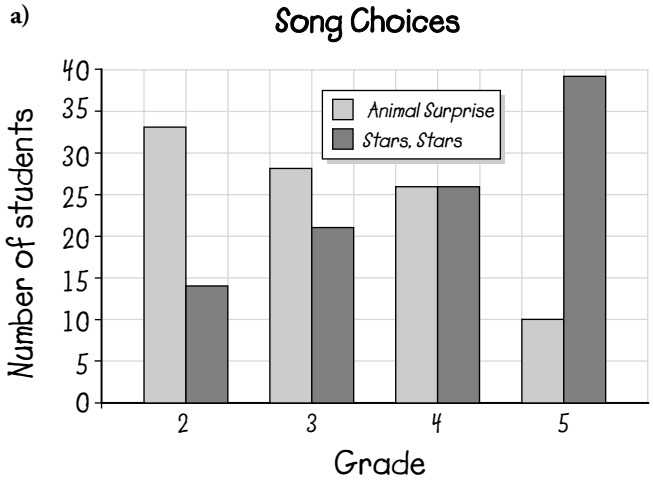
c) For example, the stem-and-leaf plot shows the data better. It is easier to read because the data are organized. I can tell at a glance which set of data has the greater stems and how the data are spread out.

2. a)



b) Friday; For example, the difference between the two bars is greatest for Friday.

3. a)



b) For example, a double bar graph shows all of the information on one graph. This makes it is easier to compare the data for the song *Animal Surprise* with the data for the song *Stars, Stars* than it would be with Josef's graphs. To do this with Josef's graphs, you would need to compare the bar for Grade 2 in one graph with the bar for Grade 2 in the other graph, and so on.

4. a) Collingwood: 10°C; Windsor: 14°°C

b) Collingwood: 5°C, 12°C; Windsor: no mode

c) Windsor; For example, the median is 14°C, which is 4°C higher than the median in Collingwood, 10°C.

5. For example,

a) 1°C 3°C 4°C 5°C 7°C 8°C 9°C

b) 1 6 8 9 11 20 25

c) 1 3 3 7 8 8 11 11 12

d) 0 1 2 3 4 5 5 6 7 8 9

A Subtracting 4-Digit Numbers

You will need

- base ten blocks

- a place value chart

Thousands	Hundreds	Tens	Ones

Goal **Use a pencil and paper method to subtract a 4-digit number.**

6028 athletes took part in the 1976 Olympics in Montréal. 4781 of those athletes were men.

? How many of the athletes were women?

Miki's Subtraction

$6028 > 6000$ and $4781 < 5000$.

$6000 - 5000 = 1000$. So, $6028 - 4781 > 1000$.

Step 1 I subtracted the ones.

```
  6028
- 4781
     7
```

Thousands	Hundreds	Tens	Ones
6	0	2	8
4	7	8	1
			7

Step 2 I need more tens and more hundreds to subtract the tens.
I'll regroup 6 thousands as 5 thousands 10 hundreds.
Then I'll regroup 10 hundreds as 9 hundreds 10 tens.
I'll have 12 tens altogether.

```
   9
 5 10 12
 6 Ø 2 8
- 4 7 8 1
       7
```

Thousands	Hundreds	Tens	Ones
5	9 ~~10~~	12	
~~6~~	~~Ø~~	~~2~~	8
4	7	8	1
			7

Step 3 Now I can subtract the tens, hundreds, and thousands.

$$\begin{array}{r} {\scriptstyle 9} \\ 5\,\cancel{10}12 \\ \cancel{6}\,\cancel{0}\,\cancel{2}\,8 \\ -\ 4\,7\,8\,1 \\ \hline 1\,2\,4\,7 \end{array}$$

1247 of the athletes were women. My estimate was greater than 1000, so, 1247 is reasonable.

Thousands	Hundreds	Tens	Ones
5	9 ~~10~~	12	
~~6~~	~~0~~	~~2~~	8
4	7	8	1
1	2	4	7

Reflecting

1. Describe a different estimation strategy for Miki.
2. Why did Miki regroup 1 thousand as 10 hundreds, and then regroup 1 hundred as 10 tens, before subtracting the tens?

Checking

3. In the 2000 Olympics in Sydney, 6582 athletes were men and 4069 were women.
   a) How many more athletes were men than women?
   b) Use addition to check.

Practising

4. Estimate. Then subtract. Use estimates to check.
   a) $4965 - 3210$ **b)** $9000 - 1863$ **c)** $1202 - 1099$
5. Add. Use subtraction to check.
   a) $2539 + 4801$ **b)** $1645 + 8219$ **c)** $5708 + 1292$
6. Explain how to use $8300 - 5091 = 3209$ to determine each difference.
   a) $9300 - 5091$ **b)** $8300 - 6091$

A Subtracting 4-Digit Numbers

Direct Instruction

Materials	• base ten blocks (thousands, hundreds, tens, ones)
Masters	• Place Value Chart: Thousands, Masters Booklet, p. 36 • (manipulatives substitute) Base Ten Blocks: Hundreds, Tens, Ones, Masters Booklet, pp. 33–35

Assessment for Feedback	What You Will See Students Doing...	
Students will	**When Students Understand**	**If Students Misunderstand**
• use base ten blocks to develop an algorithm for subtracting 4-digit numbers	• Students can regroup numbers step-by-step to determine a difference. They can also explain the reason for each step and recall the basic subtraction facts.	• Students may have difficulty regrouping or deciding when to regroup, especially with 0 in the number they are subtracting from. Have them model each step, explaining their reasons.

1. Introduction (Whole Class) ▸ 5–10 min

Present a question for subtracting a 3-digit number from a 4-digit number that requires regrouping, but not for all places. Pose questions about the subtraction, such as, "How can you estimate the difference?" Lead students to realize that 4280 is about 4000 and 924 is about 1000, so, the difference is a little greater than 3000. Have students explain the steps to subtract. Continue for a few other examples.

$$\begin{array}{r} 4280 \\ -\ 924 \\ \hline \end{array}$$

2. Teaching and Learning (Whole Class/Pairs) ▸ 15–20 min

Direct students' attention to Lesson 4A. Discuss with students the information about the Olympics. Read the central question. Discuss Miki's estimation strategy. Ensure that students understand that $6028 - 4781 > 1000$ means that the difference between 6028 and 4781 is greater than 1000.

Lead students through each step of the subtraction. Have students explain each regrouping in their own words. Pairs can model the regrouping and the subtraction with base ten blocks on a place value chart.

Reflecting Here students reflect on estimating differences and on regrouping to subtract.

Sample Discourse

1. • *6028 is about 6000. 4781 is about 5000. So, the difference is about 1000.*

2. • *2 tens are less then 8 tens. So, you need more tens before you can subtract the tens. There are 0 hundreds in 6028. You can't regroup 0 hundreds to get more tens. You need more hundreds. When you regroup 6 thousands as 5 thousands 10 hundreds, you regroup 1 thousand as 10 hundreds. Then you have the hundreds you need so that you can regroup 10 hundreds as 9 hundreds 10 tens. 1 hundred is regrouped as 10 tens.*

3. Consolidation ▸ 20–30 min

Checking (Pairs)

3. b) Reinforce that addition can be used to check subtraction.

Practising (Individual)

4. Use Assessment Tool 7, Masters Booklet, p. 8, to assess answers for this key assessment question.

Closing (Whole Class) Say, "Expo '67 was held in 1967 in Montréal. How many years ago was that?"

Answers

1.–2. See sample answers under Reflecting.

3. a) 2513

b) For example, $4069 + 2513 = 6582$

4. a) For example, $5000 - 3000 = 2000$; 1755

b) For example, $9000 - 2000 = 7000$; 7137

c) For example, 1202 is about 200 greater than 1000. 1099 is about 100 greater than 1000. $200 - 100 = 100$; 103

5. a)
$$\begin{array}{r} 7340 \\ 7340 \\ -\ 2539 \\ \hline 4801 \end{array}$$

b)
$$\begin{array}{r} 9864 \\ 9864 \\ -\ 1645 \\ \hline 8219 \end{array}$$

c)
$$\begin{array}{r} 7000 \\ 7000 \\ -\ 5708 \\ \hline 1292 \end{array}$$

6. a) 9300 is 1000 greater than 8300. So, the difference is 1000 greater than 3209; 4209

b) 6091 is 1000 greater than 5091. So, the difference is 1000 less than 3209; 2209

CHAPTER 5

A Measuring Perimeter

You will need

- 1 cm grid paper
- pencil crayons
- a ruler

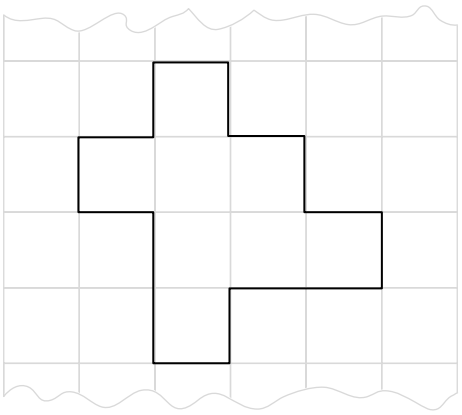
Goal **Estimate, calculate, and compare perimeters.**

Allison has 3 pieces of red string. Each is 16 cm long. She is going to use each string to make an unusual 16 cm picture frame on the cover of her scrapbook. She also has a piece of blue string that is 15 cm long. She wants to use some of this string, but not all of it, to make another frame for her scrapbook.

? What frames can Allison make with the strings?

Allison's Plan

I drew a 16 cm frame by tracing along the grid lines on centimetre grid paper.



A. Show that the perimeter of Allison's frame is 16 cm.

B. Lightly sketch another red frame Allison could draw by tracing along grid lines of centimetre grid paper. Calculate the perimeter. Outline the frame in red.

C. Repeat Part B for another red frame.

D. Make a blue frame for Allison's scrapbook by drawing slanted sides on centimetre grid paper. Estimate the perimeter.

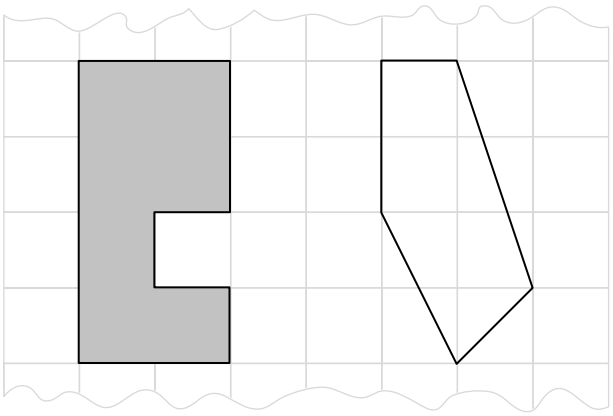
E. Measure each side. Calculate the perimeter. Can Allison make the frame with her blue string? Explain.

Reflecting

1. **a)** Explain your choice of unit in Part D.
   b) Explain your estimation strategy in Part D.
2. Explain your choice of unit for measuring in Part E.
3. If you count the number of lengths you added to calculate the perimeter, can you get the number of sides the frame has? Explain.

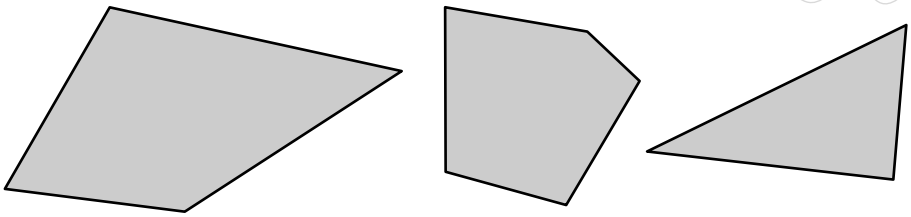
Checking

4. **a)** Estimate each perimeter.
   b) Measure, and then add to check.
   c) Draw a shape with the same perimeter as the shaded shape.



Practising

5. Terry drew these shapes.



   a) Which shapes do you think have the same perimeter?
   b) Estimate the perimeter of the other shape.
   c) Measure the side lengths. Calculate each perimeter.

6. Draw 2 quadrilaterals with the same perimeter.

7. Suppose you want to calculate the perimeter of each. Choose a unit for the sides: millimetre, centimetre, decimetre, metre, or kilometre. Explain each choice.
   a) a cell phone
   b) a calculator key
   c) a province
   d) a backyard

A Measuring Perimeter

Guided Activity

Materials	• pencil crayons • rulers
Masters	• 1 cm Grid Paper, Masters Booklet, p. 23

Assessment for Feedback	What You Will See Students Doing…	
Students will	**When Students Understand**	**If Students Misunderstand**
• estimate, calculate, and compare perimeters	• Students will correctly estimate, calculate, and compare perimeters.	• Students may have difficulty calculating the perimeter correctly. Have them measure classroom objects and calculate perimeters.

1. Introduction (Whole Class) ▸ 5–10 min

Ask, "What do you think the perimeter of your desk is? How can you estimate this? What could you use to measure your desk?" Some suggestions are string and a metre stick, or a ruler. Ensure that students know that the perimeter is the distance around an object.

2. Teaching and Learning (Whole Class/Pairs) ▸ 15–20 min

Read the problem in Lesson 5A. Ensure that students understand that each red frame will have a perimeter of exactly 16 cm, but the one blue frame will have a perimeter of less than 15 cm. Read the central question. Complete prompt A as a class. Students might count around the frame or count the length of each side and add. Have each student complete prompts B to D, consulting with a partner. Remind them to think ahead so that a frame ends where it started. Students should sketch with a pencil first so that errors can be erased. In prompt D, ensure that students include slanted sides so that some lengths are not an exact number of centimetres.

Reflecting Use these questions to ensure that students understand perimeter and can select units.

Sample Discourse

1. a) • *I chose centimetres because it's easier for me to estimate the length of a side in centimetres than in millimetres. I can add the number of centimetres mentally. Other units, such as decimetres or metres, are too long.*

• *The side lengths of the squares are in centimetres, so, that helps me estimate in centimetres.*

b) • *I compared each side of the frame to sides of squares on the centimetre grid to estimate the length of the side. I added my estimates to estimate the perimeter.*

2. • *I chose millimetres because each side is not an exact number of centimetres. If I measured each side to the nearest centimetre, the perimeter might not be precise enough to know whether I used some, but not all, of the 15 cm of string.*

3. • *The perimeter of a shape is the total of the lengths of all the sides. If each length is the length of a side, the number of measurements added shows the number of sides.*

3. Consolidation ▸ 20–30 min

Checking (Pairs)

4. Encourage discussion about choices of units.

Practising (Individual)

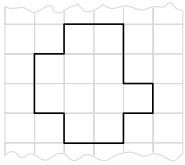
5. Use Assessment Tool 8, Masters Booklet, p. 9, to assess answers for this key assessment question.

Closing (Whole Class) Say, "Look for 2 objects with perimeters that you think are about the same. Measure the perimeters to check. How did you choose the unit?"

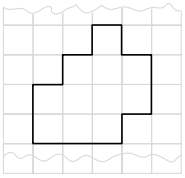
Answers

A. For example, I counted the length of each side and added, 1 cm + 1 cm + 1 cm + 1 cm + 1 cm + 1 cm + 1 cm + 1 cm + 2 cm + 1 cm + 1 cm + 2 cm + 1 cm + 1 cm = 16 cm.

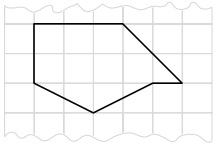
B. For example, 2 cm + 2 cm + 1 cm + 1 cm + 1 cm + 1 cm + 2 cm + 1 cm + 1 cm + 2 cm + 1 cm + 1 cm = 16 cm



C. For example, 1 cm + 1 cm + 1 cm + 1 cm + 1 cm + 1 cm + 2 cm + 1 cm + 1 cm + 3 cm + 2 cm = 16 cm



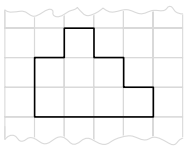
D. For example, about 13 cm



E. For example, 20 mm + 30 mm + 28 mm + 10 mm + 22 mm + 22 mm = 132 mm; Yes, because I looked at my ruler and 132 mm is less than 15 cm.

1.–3. See sample answers under Reflecting.

4. a) For example, about 14 cm; about 9 cm b) 14 cm; 97 mm c) For example,



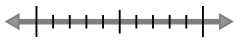
(Lesson 5A Answers continued on Supplement, p. 113)

CHAPTER 5

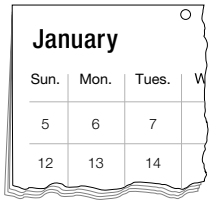
B Lengths of Time

You will need

- number lines



- a calendar



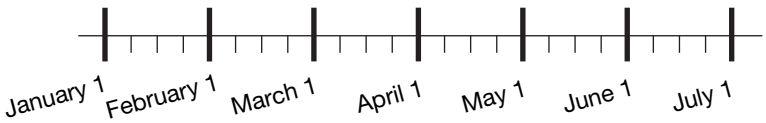
- a clock

Goal **Estimate and determine passage of time.**

The members of Josef's drama club made this schedule. They'll start 6 days before the schedule to get organized. The opening will be on June 21.

? How should they plan their time?

A. Draw a time line.
About how many months before the opening should they start?



Schedule for Our New Play

Read different plays	1 week
Choose the play	2 weeks
Choose roles	3 weeks
Practise without props	2 months
Practise with props	1 month
Practise in costumes	1 week

B. Use a calendar.
What date should they start?

C. The day before the opening, the actors want a 30 minute meeting, a 15 minute break, a 1 hour practice, and a 1 hour lunch. Then they will rehearse for 1 hour 55 minutes. They need 40 minutes to get ready for the rehearsal, and 15 minutes after it. They want to talk about the play for 1 hour at the end of the day, and to finish by 4:15 p.m. When should they start?

Use a tool such as a list, chart, time line, or clock.

Reflecting

1. What strategies did you use in Part B?

2. What strategies did you use in Part C?

B Lengths of Time

Exploration

Materials	• calendars • a clock
Masters	• Number Lines, Masters Booklet, p. 32

Assessment for Feedback	What You Will See Students Doing…	
Students will	**When Students Understand**	**If Students Misunderstand**
• estimate and determine lengths of time	• Students will correctly be able to estimate and determine lengths of time.	• Students may need help determining the beginning of a length of time. Help them show the same length of time in different ways: on a calendar or clock, on a time line, and in a chart.

1. Introduction (Whole Class) ▸ 5–10 min

Begin a discussion about what students do after school. Set a problem that relates to their lives, such as, "Suppose you want to spend an hour on school work, 15 minutes reading, and half an hour eating supper before you leave for a sports practice at 6:00 p.m. How can you plan your time so that you are ready?" Encourage different strategies.

2. Teaching and Learning (Whole Class/Pairs) ▸ 25–35 min

Read the problem in Lesson 5B together and discuss the central question. Help students get started with prompt A. Have each student draw a time line as they share ideas with a partner. They could mark the first of each month on a number line and draw arrows to show lengths of time. Students may need help marking the opening date, June 21, on their time lines and matching the last part of the schedule, *Practise in costumes*, with the opening date. Ensure that students include the 6 days to get organized.

For prompt B, discuss the different numbers of days in the months of the year, and remind students that the number of days in February depends on whether it is a leap year. Prompt C gives students the experience of interpreting information from a paragraph. Emphasize that going backward from 4:15 p.m. makes sense because they are looking for the start time. They could go forward to check their answers.

Reflecting Use these questions to encourage students to discuss their strategies and their classmates' strategies.

Sample Discourse

1. • *I found June 21 on a calendar. I counted backward for 1 week to June 14 for the start of practising in costumes, 1 month to May 14 for practising with props, 2 months to March 14 for practising without props, 3 weeks to February 21 for choosing roles, 2 weeks to February 7 for choosing the play, 1 week to January 31 for reading different plays, and 6 days to January 25 for getting organized.*

• *I counted backward on a calendar for a leap year and got January 26 for the start.*

2. • *I started at 4:15 p.m. and worked backward in a chart to figure out the finish time and start time for each. I began with the 1 hour discussion at the end of the day.*

• *I listed all the lengths of times. I added the number of hours and the number of minutes. I rewrote the number of minutes as a number of hours and minutes. I added these together, and then I counted backward for the number of hours and minutes from 4:15 p.m.*

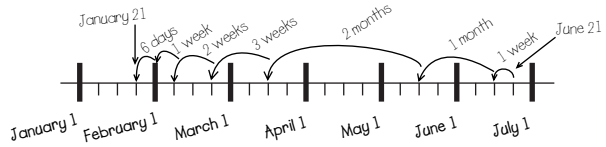
• *We looked at a clock to figure out the starting time for each activity, starting with the 1 hour at the end of the day.*

3. Consolidation ▸ 10–15 min

Closing (Whole Class) Ask, "When might you estimate a total length of time for a few events? How would you estimate?" To help students get started, talk about how going to a movie might include walking to the bus, waiting for the bus, riding the bus, walking from the bus stop to the theatre, buying tickets, buying popcorn, and finding a seat. Remind them again that working backward is a useful strategy.

Answers

A. For example, about 5 months



B. January 25; For example, I counted backward on a calendar for the lengths of time and that is the date where I ended.

C. 9:40 a.m. For example, day finishes at 4:15 p.m., play discussion starts at 3:15 p.m., rehearsal ends at 3:00 p.m., rehearsal starts at 1:05 p.m., lunch ends at 12:25 p.m., practice ends at 11:25 a.m., break ends at 10:25 a.m., meeting ends at 10:10 a.m., meeting starts at 9:40 a.m..

1.–2. See sample answers under Reflecting.

Math Background

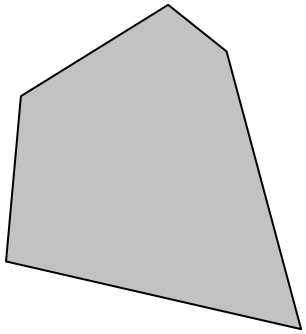
It is important for students to realize that all the months stay the same length from year to year, except for February. During leap years, one day is added to the end of February.

Chapter Review

LESSON

A

1. **a)** Estimate the perimeter. Explain your strategy.
b) Measure the side lengths. Calculate the perimeter.
c) Did you use the same unit to estimate the perimeter and to measure the lengths of the sides? Why or why not?



2. **a)** Draw along grid lines on centimetre grid paper to create 2 shapes with the same perimeter.
b) What is the perimeter? How do you know?

3. **a)** Find an object that you think has a perimeter of about 2 m.
b) Measure the side lengths. How did you choose the unit?
c) Calculate the perimeter.

B

4. Calvin wants to meet a friend at 11:30 a.m. on the rink. It takes Calvin 15 minutes to get ready to leave, an hour to walk to the bus and then ride to the arena, 10 minutes to put on his skates, and 5 minutes to talk to friends before he gets on the rink. When should he start getting ready?

5. Miki's project is due on March 15. She wants to have a week to choose a topic, 2 weeks to research data, a month to organize and write the project, and a week to illustrate it.
a) What date should she start?
b) Describe your strategy.

6. Suppose you are having a party at 5:00 p.m. on Saturday.
a) List at least 4 things you might do to get ready for your guests. Estimate a length of time for each.
b) When should you start getting ready?
c) Explain how you figured out the starting time.

Chapter Review Lessons A and B

Using the Chapter Review

Materials	• rulers • metre sticks • a clock • calendars
Masters	• 1 cm Grid Paper, Masters Booklet, p. 23 • Number Lines, Masters Booklet, p. 32

Use this supplemental review to assess students' understanding of the concepts developed in Lessons 5A and 5B. All questions can be used for summative assessment.

1. c) Discuss the advantages of estimating lengths in each unit. For example, students might estimate lengths of sides in centimetres and add the lengths. Alternatively, some students might estimate the lengths in millimetres to the nearest 10 mm and add these numbers. Emphasize that either of these is reasonable. Talk about why it is important to measure the lengths in millimetres since measuring to the nearest centimetre would not result in a precise perimeter. Ensure that students realize that the estimates may vary. For example, the length of a side that is 38 mm may look as though it is 3 cm or 4 cm long.

3. Discuss why there is more than one reasonable unit.

6. Remind students who are having difficulty to use a time line, a list, or a calendar.

Related Questions to Ask

Ask	Possible Response
About **Question 3b)**: • Is metres a good choice of units? Why or why not?	• *No. When the perimeter is 2 m, each side would be less than a metre, so a smaller unit, such as centimetres, is a better choice.*
About **Question 5**: • Why is counting backward a good strategy for finding a start date?	• *It is easier to figure out the answer by counting backward than by trying to guess a start date and counting forward to find out if the time matches.*

Answers

1. a) For example, about 13 cm. I estimated the length of each side in centimetres. That's about 2 cm, 2 cm, 1 cm, 4 cm, and 4 cm. Then I added the lengths to get 13 cm.

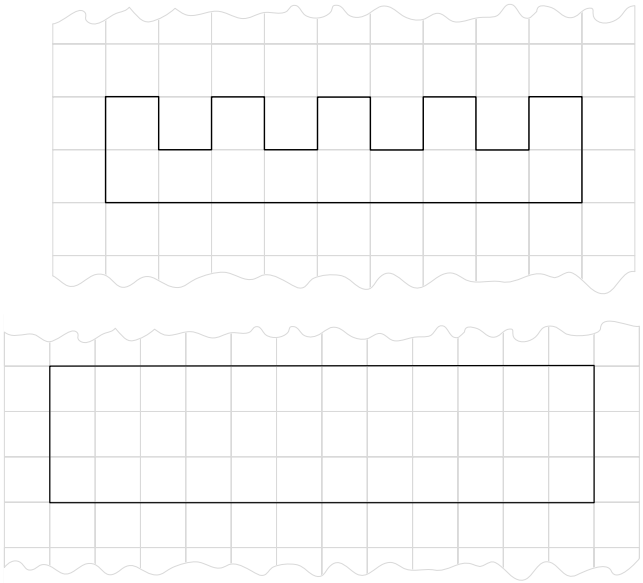
For example, about 130 mm. I estimated the length of each side in millimetres. That's about 20 mm, 20 mm, 10 mm, 40 mm, and 40 mm. Then I added the lengths to get 130 mm.

b) 22 mm, 23 mm, 10 mm, 38 mm, 40 mm; 133 mm

c) For example, no. I estimated in centimetres because it is easier to estimate in centimetres than millimetres and it is easier to add the number of centimetres mentally than millimetres. Some side lengths are not an exact number of centimetres, so, I measured in millimetres to get a more precise measurement.

For example, yes. I measured in millimetres to get precise measurements. I wanted to use the same unit to estimate to make it easier to compare the estimate with the calculated perimeter. I estimated to the nearest 10 mm because I can add the estimates mentally.

2. a) For example,



b) 30 cm; For example, I counted to find the length of each side on the grid paper and added.

3. a) For example, my desk

b) For example, decimetres because I think that is more precise than metres. If I used centimetres, it would be too difficult to add.

c) For example, 19 dm

4. 10:00 a.m.

5. a) January 18

b) For example, I started at March 15 on a calendar. I counted back for 1 week to get March 8. I counted back 1 month to February 8, and then 2 weeks to January 25, and then 1 more week to January 18.

6. a) For example, clean up the room for the party, 30 minutes; shop for snacks, 1 hour; put out snacks and take the games out, 20 minutes; get myself ready for the party, 25 minutes.

b) For example, 2:45 p.m.

c) For example, I added up all the hours and minutes and got 2 hours and 15 minutes.

For example, I counted backward from 5:00 p.m., 25 minutes to 4:35 p.m., 20 minutes to 4:15 p.m., 1 hour to 3:15 p.m., and 30 minutes to 2:45 p.m.

CHAPTER 7

A Comparing Angles

You will need

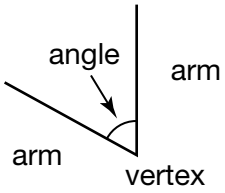
- paper for folding
- a protractor

Goal **Compare angles to a straight angle, a right angle, and half a right angle.**

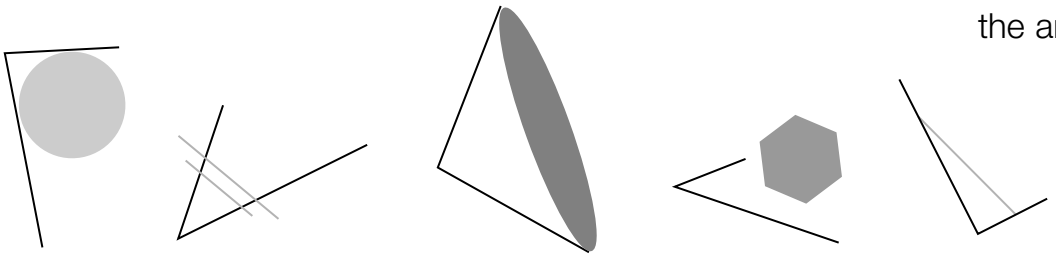
Jon's group created these **angle** optical illusions.

? How can you use folded paper to order the angles from least to greatest?

angle

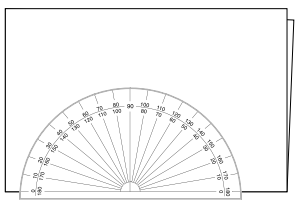


The **arc** shows the angle.



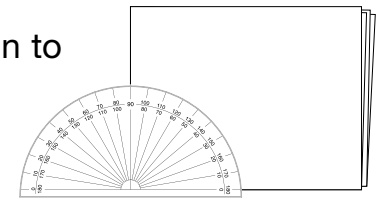
Jon's Method

I folded my paper in half to make a **straight angle**. I put the line of my protractor with the 0° mark over one arm of the straight angle. The **degree** measure at the other arm of the angle is 180°.



I folded my paper in half again to make a **right angle**.

I can read the scale from 0° at one arm to 90° at the other arm.



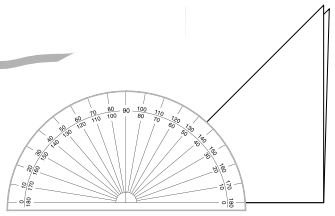
straight angle
An angle made by a straight line

degree (°)
A unit for measuring angles
90° is read 90 degrees.

right angle
An angle that is a square corner

I folded my paper in half again to make half a right angle.

Half a right angle is 45°.



A. Fold a piece of paper like Jon did.

B. Use your folded paper to compare Jon's angle with a straight angle, a right angle, and half a right angle.

C. Repeat Part B for the other angles.

D. Order the angles from least to greatest.

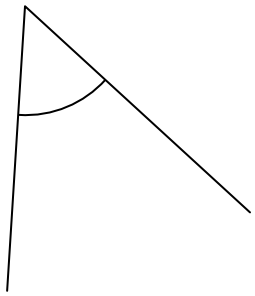
Reflecting

1. How does Jon know that half a right angle is 45°?

2. Explain how you can use your descriptions to order the angles.

Checking

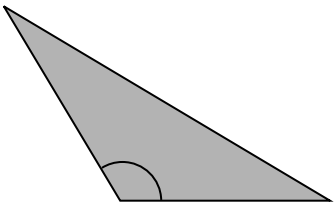
3. Compare this angle with your folded paper.



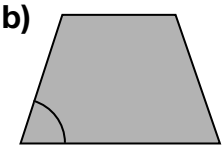
Practising

4. Use your folded paper. Compare each marked angle to one or more of these angles: straight angle, right angle, or half a right angle.

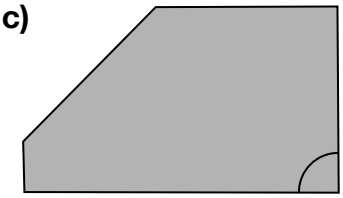
a)



b)



c)



5. Mandy created some angle riddles.

a) I am half a straight angle. What kind of angle am I?

b) My measure is the same size as 4 angles of 45° put together. What kind of angle am I?

A Comparing Angles

Guided Activity

Materials	• paper for folding • protractors • (optional) straws
Masters	• (optional) 1 cm Grid Paper, Masters Booklet, p. 23

Assessment for Feedback	What You Will See Students Doing…	
Students will	**When Students Understand**	**If Students Misunderstand**
• compare angles to a straight angle, a right angle, and half a right angle	• Students will correctly compare angles to a straight angle, a right angle, and half a right angle.	• Student may have difficulty comparing the sizes of the angles. Have them use straws to form different angles to measure with their folded paper. Alternatively, they can trace angles and place the tracing on grid paper to compare angles.

1. Introduction (Whole Class) ▸ 5–10 min

Ask students to find square corners on their desks, pencil cases, or books. Demonstrate, using a piece of paper, what a right angle looks like. Remind students about the term *right angle*. Have students use square corners to find right angles and to identify angles that are greater than, equal to, or less than a right angle.

2. Teaching and Learning (Whole Class/Pairs) ▸ 20–25 min

Read the problem and central question in Lesson 7A. Work through Jon's Method with the students. Discuss the terms *straight angle* and *right angle*, having students place their protractors over the pictures of protractors. Ensure that students understand how a protractor shows the measurements of a right angle, a straight angle, and half a right angle. Ask, "Does the length of the arms of an angle change the size of the angle?" Use the optical illusions to show that arm lengths do not affect the size of an angle. Guide students for prompts A and B, and then have them continue with prompts C and D. Discuss answers.

Reflecting Here, students discuss the degree measure of half a right angle using folded paper as a reference tool for angles.

Sample Discourse

1. • *Jon can follow the scale from 0° to 45°.*
- *A right angle is 90°. The measure of half a right angle is half of 90°. I can check by multiplying 2 times 45°, which is 90°.*

2. • *I can order the angles from least to greatest, starting with Pedro's angle, which is less than half a right angle; Zola's angle, which is half a right angle; Jon's angle, which is greater than a half a right angle and less than a right angle; Manitok's angle, which is a right angle; and Carmen's angle, which is greater than a right angle.*

3. Consolidation ▸ 15–25 min

Checking (Pairs)

3. Students may describe the angle using a piece of paper that is folded to represent a right angle or half a right angle.

Practising (Individual)

4. Use Assessment Tool 7, Masters Booklet, p. 8, to assess answers for this key assessment question.

Closing (Whole Class) Have students find angles in the classroom to match different descriptions and use folded paper or a measuring tool to check. For example, find an angle that is close to half a right angle, an angle which is a little greater than a right angle, an angle which is almost a straight angle, or an angle which is greater than half a right angle but less than a right angle.

Answers

B. For example, greater than half a right angle and a little less than a right angle

C. For example, Zola, half a right angle; Carmen, a little greater than a right angle and a lot less than a straight angle; Pedro, less than half a right angle; Manitok, right angle

D. Pedro, Zola, Jon, Manitok, Carmen

1.–2. See sample answers under Reflecting.

3. For example, a little greater than half a right angle and a lot less than a right angle

4. **a)** For example, greater than a right angle and less than a straight angle

b) For example, less than a right angle and greater than half a right angle

c) right angle

5. **a)** right angle **b)** straight angle

Math Background

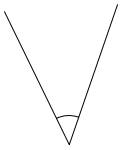
It is important for students to know that the arm lengths are completely independent of the angles. The arms, also called rays, can continue forever and never affect the measure of the angle. Square corner is a useful term for a right angle because many students can visualize whether an angle is a square corner.

Chapter Review

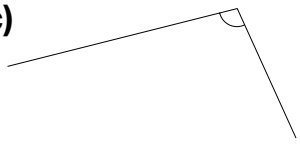
LESSON A

Use folded paper to help you answer these questions.

1. Compare each marked angle to one or more of these angles: straight angle, right angle, or half a right angle.

a) 

b) 

c) 

2. Use the words straight angle, right angle, and half a right angle to describe the angles in each pattern block.

a) a tan rhombus pattern block

c) a red trapezoid pattern block

b) a green triangle pattern block

3. Find an object in your classroom with each angle.

a) less than half a right angle

b) almost 180°

c) a straight angle

d) between 45° and 90°

4. Use these angle names to make the sentences true.

a straight angle a right angle half a right angle

a) The angle measure of ■ is 45°.

b) A square pattern block can be a measuring tool for ■.

c) A right angle is twice ■.

d) Each angle on a hexagon pattern block is closest to ■.

e) The least angle on a blue rhombus pattern block is closest to ■.

f) The angle that looks like a straight line is ■.

Chapter Review Lesson A

Using the Chapter Review

Materials	• paper for folding • pattern blocks
Masters	• (manipulatives substitute) Pattern Blocks, Masters Booklet, p. 38

Use this supplemental review to assess students' understanding of the concepts developed in Lesson 7A. All questions can be used for summative assessment.

2. Students who are experiencing difficulties with the pattern blocks may need help placing their folded paper at the vertices of angles. Encourage students to relate the shown angles to the benchmark angles by using the terms less than and greater than.

4. d) Students may not realize that the angles in a hexagon pattern block are the same size. If possible, demonstrate this by placing a hexagon pattern block on an overhead projector and using folded paper to compare angles.

Related Questions to Ask

Ask	Possible Response
About **Question 1**: • Do you think folded paper is a good tool for describing angles?	• *Yes, because it shows how angles compare with half a right angle, a right angle, or a straight angle.*
About **Question 4**: • How is a straight angle the same as a straight line?	• *I can fit the edge of my book along either one.*

Answers

1. a) half a right angle

b) For example, a little less than a straight angle and much greater than a right angle

c) For example, a little greater than a right angle and much less than a straight angle

2. a) For example, the 2 small angles are less than half a right angle, and the 2 larger angles are closest to a straight angle and much greater than a right angle.

b) For example, all 3 angles are greater than half a right angle and less than a right angle, or about halfway between half a right angle and a right angle.

c) For example, the 2 smaller angles are about halfway between half a right angle and a right angle, and the 2 larger angles are about halfway between a right angle and a straight angle.

3. a) For example, the arms of a closed stapler

b) For example, an open book

c) For example, a ruler

d) For example, a green triangle pattern block

4. a) half a right angle

b) a right angle

c) half a right angle

d) a right angle

e) half a right angle

f) a straight angle

Chapter Task

Shape Names

Poly Gon is having a math party. She wants a name tag for each of her guests, but she has rules for the tags.

- More than half, but not all, of the name tags are quadrilaterals.
- 4 of the name tags have an angle greater than a right angle.
- Only 3 of the name tags are congruent.
- 1 name tag has 2 angles that are half a right angle.
- Exactly 4 of the name tags have a line of symmetry.

Task Checklist
☑ Did you include diagrams?
☑ Did you use math language?
☑ Did you verify that your name tags agree with Poly's rules?
☑ Did you organize your work so it is easy to follow?

? How can you make and describe 10 different name tags for Poly's party?

A. Create 10 name tags to fit Poly's rules.

B. Completely describe each of the name tags you made.

CHAPTER 9

A Multiplying with an Algorithm

You will need

- base ten blocks

- a place value chart

Hundreds	Tens	Ones

Goal **Multiply using a procedure.**

Terry has 56 hockey cards. Pedro has twice as many.

? How many hockey cards does Pedro have?

Terry's Calculations

I'll multiply to find out how many cards Pedro has.

Step 1 First, I estimate.
56 is about 60. $2 \times 60 = 120$

Step 2 I calculate by making 2 groups of 56.
I see 2×6 ones, or 12 ones.
I regroup 12 ones as 1 ten, 2 ones.

Hundreds	Tens	Ones

1 ten → $^{1}56$
$\times 2$
2 ones → 2

Step 3 I see 2×5 tens blocks + 1 tens block.

Hundreds	Tens	Ones

56
$\times 2$
112
1 hundred
1 ten

Step 4

Hundreds	Tens	Ones
■	▮	⁝

$$\begin{array}{r} 56 \\ \times 2 \\ \hline 112 \end{array}$$

112 is just a bit less than my estimate of 120, so my answer is reasonable. Pedro has 112 hockey cards.

Reflecting

1. In Step 2, why did Terry record a 1 above the 5?

Checking

2. Chantal has 45 plastic horses. She says she has 3 times as many other animals. How many other animals does she have?
Estimate. Then calculate the answer.

Practising

3. Sarah's art class made 79 mugs.
Jon's art class made 4 times as many.
How many mugs did Jon's class make?
Explain your answer.

4. Estimate. Then calculate each product. Compare the product with your estimate.

a) 25×9 b) 63×3 c) 94×7 d) 48×8

A Multiplying with an Algorithm

Guided Activity

Materials	• base ten blocks (hundreds, tens, ones)
Masters	• (manipulatives substitute) Base Ten Blocks, Masters Booklet, pp. 33–35 • Place Value Mat, Masters Booklet, p. 36

Assessment for Feedback	What You Will See Students Doing…	
Students will	**When Students Understand**	**If Students Misunderstand**
• multiply 2-digit by 1-digit numbers	• Students will model and record the multiplication algorithm accurately.	• Students may have difficulty connecting the symbol to the place value. Model and emphasize the use of place value language. Help students understand that multiplying a 2-digit number by a 1-digit number requires adding two products. For example, 54 × 3 is 50 × 3 plus 4 × 3.

1. Introduction (Whole Class) ▸ 5–10 min

Prepare students for the multiplication algorithm by reviewing how to show regrouping when adding. Use base ten blocks to model the addition of 2-digit numbers, for example, 89 + 62. Ask, "How do you record what you do when you add the groups of blocks?" Emphasize the regrouping.

2. Teaching and Learning (Whole Class/Pairs) ▸ 15–20 min

Read the problem and the central question in Lesson 9A as a class. Lead students to briefly discuss a plan for solving the problem. Then focus their attention on Terry's solution and compare their plans to his. Discuss Terry's estimation strategy and the estimation strategies suggested by students. Have students use base ten blocks on place value charts to model the multiplication with a partner. Ensure that they understand regrouping 10 ones as 1 ten and 10 tens as 1 hundred.

Reflecting Use these questions to ensure that students understand how to multiply a 2-digit number by a 1-digit number with an algorithm.

Sample Discourse

1. • *The 1 above the 5 shows that 10 ones are regrouped as 1 ten. The 1 ten is added to the product of 2 times 5 tens.*

3. Consolidation ▸ 20–30 min

Checking (Pairs)

2. Check to see that students are using place value language, such as referring to the places as tens and ones.

Practising (Individual)

4. Use Assessment Tool 7, Masters Booklet, p. 8, to assess answers for this key assessment question.

Closing (Whole Class) Have students summarize their learning about multiplying with an algorithm by asking, "Explain how you could use an algorithm to calculate the product of 8 × 63." Continue with other examples of multiplying a 2-digit number by a 1-digit number, including some with regrouping and some without. Then ask, "How do you know whether to regroup ones as a ten? How do you know whether to regroup tens as a hundred?"
Have students make up a 2-digit or 1-digit multiplication problem about a hobby or game that interests them. Have them solve it.

Answers

1. See sample answer under Reflecting.
2. For example, 45 is about 50. 3 × 50 = 150; 135
3. 316
4. a) For example, 30 × 9 = 270; 225
b) For example, 60 × 3 = 180; 189
c) For example, 90 × 7 = 630; 658
d) For example, 50 × 8 = 400; 384

CHAPTER 9

B Multiplication Patterns

You will need

- a calculator

Goal **Create, describe, and extend multiplication patterns.**

Sarah and Pedro plan to research information about recycling each day this week from Monday to Saturday.

Sarah's goal is to find 1 website on Monday, and then double the number of websites each day.
Pedro's goal is to find 1 website on Monday, and then triple the number of websites each day.

? How many more websites will Pedro find than Sarah on Saturday?

A. Complete this table to show the number of websites each day until Saturday for Sarah's goal.

B. Describe the pattern for Sarah's goal.

C. Complete a table like Sarah's for Pedro's goal.

D. How many more websites are needed on Saturday for Pedro's goal than for Sarah's? How do you know?

Day (term number)	Number of websites each day (term)
Monday (1)	1
Tuesday (2)	2
Wednesday (3)	4

Reflecting

1. Explain your strategy for Part C.

2. How are Sarah's and Pedro's patterns the same? How are they different?

B Multiplication Patterns

Exploration

Materials	• calculators • (optional) counters

Assessment for Feedback	What You Will See Students Doing…	
Students will	**When Students Understand**	**If Students Misunderstand**
• create, describe, and extend multiplication patterns	• Students will be able to correctly create, describe, and extend multiplication patterns.	• Students may experience difficulty extending multiplication patterns. Encourage them to model the patterns with concrete materials such as counters or use a calculator. Invite students to describe the patterns after extending them.

1. Introduction (Whole Class) ▸ 5–10 min

To introduce the concept of forming a pattern by doubling a number, present students with the following problem: "You can receive $1 on the 1st day and double the amount each day for a week or you can receive $5 per day for a week. Which way would give you more money at the end of the week? Why do you think this?" Lead students to discuss ways to solve the problem, such as by using counters.

2. Teaching and Learning (Whole Class/Pairs) ▸ 25–35 min

As a class, read the problem in Lesson 9B. Ensure that students understand each pattern. Discuss what is meant by doubling or tripling a number. For example, doubling means multiplying by 2. Discuss the prefix tri- and relate it to words such as triangle and tricycle. Ask, "What is meant by tripling a number?" Then read the central question. Have calculators available for students who need them. Use examples in Sarah's table to remind students that term means each number or item in a pattern and term number tells the position of a term in a pattern. In pairs, have students complete prompts A and B. Then discuss the answers together. Have them complete prompts C and D in pairs before talking about the answers with the class. Ask students how they chose the operation for prompt D.

Reflecting These questions lead students to reflect on multiplication patterns.

Sample Discourse

1. • *I wrote 1 for the 1st term because Pedro's goal is to find 1 website on Monday. Each term in Pedro's pattern is triple, or 3 times, the term before it. So I multiplied each term by 3 to get the next term.*

2. • *Sarah's and Pedro's patterns are both multiplication patterns. They are both growing patterns. For Sarah's pattern, I multiplied each term by 2 to get the next term. For Pedro's pattern, I multiplied each term by 3 to get the next term.*

3. Consolidation ▸ 10–15 min

Closing (Whole Class) To help students consolidate their learning, give them examples of a multiplication pattern and an addition pattern. Ask, "How are they different? How are they the same?" Elicit from students that addition and multiplication patterns are both growing patterns, but multiplication patterns grow much faster than addition patterns.

Answers

A.

Day (term number)	Number of websites each day (term)
Monday (1)	1
Tuesday (2)	2
Wednesday (3)	4
Thursday (4)	8
Friday (5)	16
Saturday (6)	32

B. For example, each term in Sarah's table is double the term before it.

C.

Day (term number)	Number of websites each day (term)
Monday (1)	1
Tuesday (2)	3
Wednesday (3)	9
Thursday (4)	27
Friday (5)	81
Saturday (6)	243

D. 211; For example, Pedro needs 243 websites to reach his goal and Sarah needs 32 websites for her goal. I subtracted 32 from 243 to get 211.

1.–2. See sample answers under Reflecting.

Math Background

It is useful for students to know that numbers in multiplication patterns increase much faster than in addition patterns. This understanding will help them to better grasp exponents later on.

CHAPTER 10

A Missing Factors

You will need

- base ten blocks

- a calculator

Goal **Determine the missing factor in multiplication equations.**

Paulette had 7 boxes of prizes for a fish pond game with an equal number of prizes in each box.
She dropped the boxes and had to put the prizes back in.
She counted 98 prizes.

Paulette's Equation

I can use the equation $7 \times \blacksquare = 98$ to represent the boxes of prizes.

? How many prizes were in each box?

A. How does $7 \times \blacksquare = 98$ represent the boxes of prizes?

B. Predict the missing factor in $7 \times \blacksquare = 98$.
Use a calculator to check. If your prediction is not the missing factor, try another prediction.

C. Show how to use the relationship between multiplication and division to complete $7 \times \blacksquare = 98$.

D. Find a different way to complete $7 \times \blacksquare = 98$.

E. How many prizes were in each box?

Reflecting

1. Explain how you predicted in Part B.

2. Compare strategies for completing $7 \times \blacksquare = 98$ with strategies for completing $7 \times \blacksquare = 28$.

3. Explain how to determine each missing factor.
a) $9 \times \blacksquare = 99$ **b)** $\blacksquare \times 3 = 72$ **c)** $5 \times \blacksquare = 85$

A Missing Factors

Exploration

Materials	• calculators • base ten blocks (tens, ones)
Masters	• (manipulatives substitute) Base Ten Blocks, Masters Booklet, pp. 33–34

Assessment for Feedback	What You Will See Students Doing…	
Students will	**When Students Understand**	**If Students Misunderstand**
• be able to determine the missing factors in multiplication equations	• Students will correctly determine the missing factors in multiplication equations.	• Students may have difficulty making reasonable predictions about the missing factors. They might refer to a multiplication table for benchmark numbers.

1. Introduction (Whole Class) ▸ 5–10 min

On the board, present addition and subtraction equations such as ■ + 2 = 7, ■ + 5 = 11, 12 − ■ = 4. Ask, "How would you figure out the missing number in each equation?" Encourage discussion about a variety of strategies.

2. Teaching and Learning (Whole Class/Pairs) ▸ 20–30 min

As a class, read the problem and the central question in Lesson 10A. Discuss some strategies that could be used to find the missing factor. For example, suggest that students use guess and check, base ten blocks, or a calculator. Complete prompt A as a class. Have students work in pairs for prompts B and C. Discuss the answers as a class. Emphasize the relationship between addition and subtraction, and between multiplication and division. Have students complete prompts D and E in pairs.

Reflecting These questions lead students to reflect on strategies for determining the missing factor in a multiplication equation.

Sample Discourse

1. • *I multiplied mentally for 7 × 10 = 70. 98 is quite a bit greater than 70, so I tried 15 for the missing factor. I used a calculator to multiply 7 × 15 = 105. 98 is less than 105, so I used a calculator to multiply 7 × 14 and got 98. The missing factor is 14.*

2. • *To complete either equation, I can divide the product by 7 to determine the missing factor. For 7 × ■ = 98, I need to write the steps for the division or use models. For 7 × ■ = 28, I know that the missing factor is 4 because I know the multiplication fact 7 × 4 = 28.*

3. a) • *I know 10 × 10 is 100 so I guessed that the missing factor might be 10. I mentally multiplied 9 × 10 = 90. The product was too low so I tried 11 as the missing factor. I used a calculator to multiply 9 × 11 and got 99. So the missing factor is 11.*

b) • *I can divide 72 by 3. The missing factor is 20 + 3 = 23.*

c) • *I can represent 85 with base ten blocks for 8 tens 5 ones and divide them into 5 equal groups to get 17. The missing factor is 17.*

• *I can start at 5 and skip count by 5s. The 17th term in the pattern is 85, so the missing factor is 17.*

3. Consolidation ▸ 15–20 min

Closing (Whole Class)
Ask, "How is completing 5 × ■ = 75 the same as completing ■ × 5 = 75? How is it different?" Discuss that the order of the factors does not change the product. You might have students use materials to demonstrate this for the class.

Answers

A. For example, there are 7 boxes with an equal number of prizes in each. There are 98 prizes altogether.

B. For example, about 14

C. For example, I know that multiplication and division are related, so if 7 × ■ = 98, 98 ÷ 7 = ■. So, I divided 98 by 7 to get the missing factor. It's 14.

D. For example, I can show 7 equal groups of 14 counters to get 98 counters. So, I know that 7 × 14 = 98.

E. 14

1.–3. See sample answers under Reflecting.

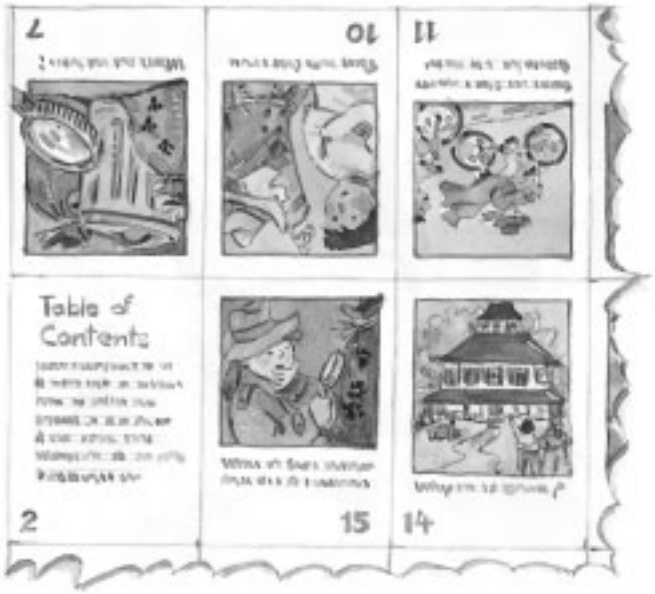
Chapter Task

Printing Pages

Book pages are printed on large sheets of paper called forms. All pages for a book are on the forms. This includes blank pages at the beginning and end of the book. Each form contains the same number of pages, so the number of pages in a book will always divide by that number with no remainder. After the forms are printed, they are cut apart so the pages can be bound.

Title	Pages
The Girl Who Loved Wild Horses	32
The Missing Sun	48
Dolphins at Daybreak	72
Jacob Two-Two and the Dinosaur	88
Cam Jansen and the Birthday Mystery	64
Esio Trot	64
The Good, the Bad, and the Goofy	72

? How many pages can be on a form? Explain your answer.



Task Checklist

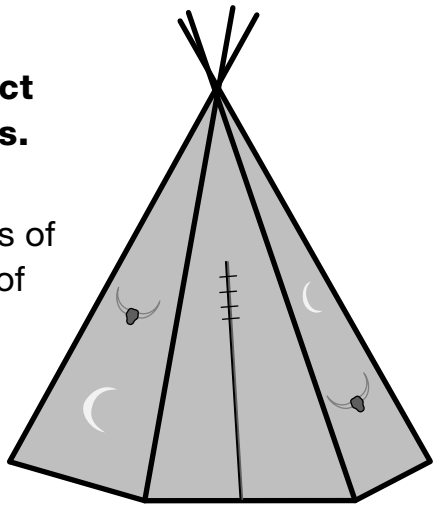
- ☑ Did you show your steps?
- ☑ Did you use math language?
- ☑ Did you explain your thinking?

CHAPTER 11

A Using Nets

Goal **Use nets to construct pyramids and prisms.**

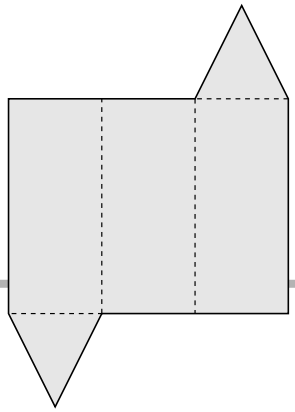
Carmen is building 3-D models of homes that are in the shapes of prisms and pyramids.



? How can Carmen make nets and build 3-D models?

Carmen's Net

I want to make a net. I want to use the net to make a prism that is congruent to the model. So, I'll trace each face of the model.



A. Name the shape of each face of a triangle-based prism.
How many faces are there for each shape?
How many vertices does the model have?
How many edges does the model have?

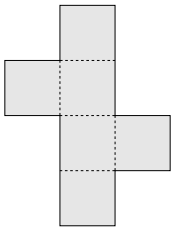
You will need

- 3-D models

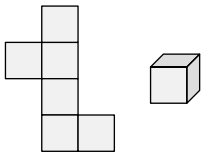
- paper
- stickers
- scissors

- tape

- nets



net
A 2-D pattern that can be folded into a 3-D shape



net for a cube

B. Trace 1 face. Put a sticker on that face of the model to show that it has been traced.
Roll the prism over an edge so that you can trace a face connected to the face you just traced. Trace this face. Put a sticker on this face of the model.

C. Repeat Part B until you have traced each face once. You may need to roll the prism back over a traced face.

D. Cut out the net. Fold and tape it to make the prism.

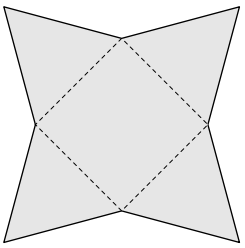
Reflecting

1. Look at the net and its 3-D model. How are they the same? How are they different?

2. Why is it important to pay attention to which faces are connected when you draw a net?

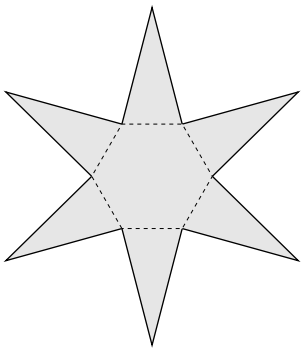
3. The tracings of the 2 bases of a prism never touch on its net. Explain why this makes sense.

Checking



4. a) Use a net like this to make a square-based pyramid.
b) Name the shape of each face of the 3-D shape.
c) Which faces of the 3-D shape are congruent?

Practising



5. a) Use a net like this to make a 3-D shape.
b) Name the 3-D shape. How do you know?
c) How many edges does the 3-D shape have?

6. a) Create a net for a rectangle-based prism.
b) Describe the net.
c) Use the net to make a prism.

A Counting Patterns

Guided Activity

Materials	• 3-D models • paper • stickers • scissors • closed cardboard boxes
Masters	• Nets, Supplement, p. 112

Assessment for Feedback	What You Will See Students Doing…	
Students will	**When Students Understand**	**If Students Misunderstand**
• use and describe nets for prisms and pyramids	• Students will be able to correctly use and describe nets for prisms and pyramids.	• Some students may have difficulty describing nets. Guide them in comparing nets with models, focusing on one part at a time. Include faces, edges, and vertices.

1. Introduction (Whole Class/Pairs) ◗ 5–10 min

In pairs, have students take apart an empty cardboard box and lay it flat on a surface. Ask, "How is this the same as the box? How is it different?" Have each pair fold their net back into its original shape.

2. Teaching and Learning (Whole Class/Pairs) ◗ 15–20 min

Draw students' attention to the picture at the top of Lesson 11A. Discuss Carmen's statements and the meanings of congruent and net. Read the central question. Have students work through prompts A to D in pairs, with each student drawing a net. Ensure that, when students are rolling over the model, they place the edge of each new face exactly on the line made by the previous face.

Reflecting Use these questions to ensure that students understand the relationship between a net and its 3-D model.

Sample Discourse

1. • *The net is the same as its model because each face of the model matches a section of the net. They are different because the net is 2-D and the model is 3-D. The shapes on the net have more vertices than the model. If you fold the net, the 3-D shape has the same number of edges and vertices as the model.*
2. • *When you fold a net, the faces need to connect to make the 3-D shape. So each fold on the net must be an edge for the correct faces.*
3. • *If you stand a prism on a base, the other base is at the top of the prism, so the bases of the prism never meet. The tracings of the bases cannot touch on a net because the bases never share an edge.*

3. Consolidation ◗ 20–30 min

Practising (Individual)

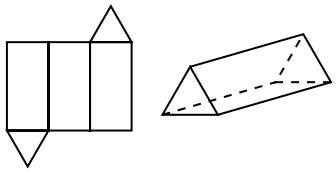
5. Use Assessment Tool 8, Masters Booklet, p. 9, to assess answers for this key assessment question.
6. To emphasize that it is possible to represent the same 3-D shape with different nets, have students compare their results with each other.

Closing (Whole Class) Ask, "What can you tell about a prism or pyramid from its net? Can you tell how many edges it has by its net? Why or why not?"

Answers

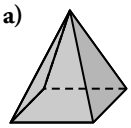
A. Triangle, triangle, rectangle, rectangle, rectangle; 2 triangle faces, 3 rectangle faces; 6 vertices; 9 edges

B.–D.



1.–3. See sample answers under Reflecting.

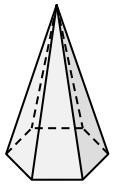
4. a)



b) triangle, triangle, triangle, triangle, square

c) 4 triangle faces

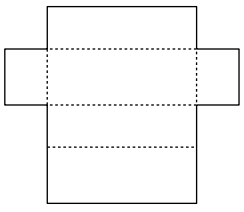
5. a)



b) hexagon-based pyramid; For example, the base is a hexagon and the other faces are triangles, which all meet at one vertex at the top.

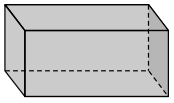
c) 12

6. a) For example,



b) For example, it has 6 faces, 8 vertices, and 12 edges. Each face is a rectangle.

c)



B Sketching Models

You will need

- skeleton models created for Lesson 3
- toothpicks and modelling clay

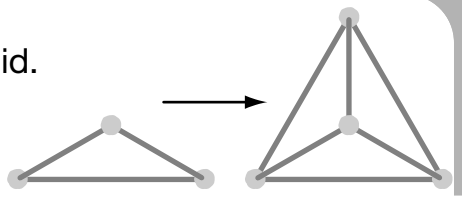
Goal **Sketch skeletons of 3-D models.**

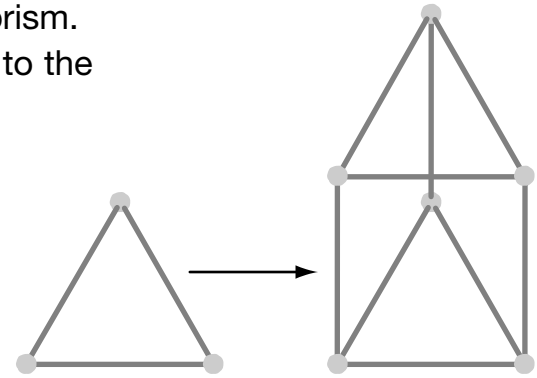
? How can you sketch skeletons of 3-D shapes?

Pedro's Sketches

I sketched the base of my triangle-based pyramid. Then I drew a dot for the top vertex, and joined it to each vertex of the base.

I sketched the base of my triangle-based prism. Then I sketched the face that is congruent to the base, and joined the matching vertices.





A. Make or use a skeleton of any pyramid. Sketch it.

B. Repeat Part A for a different pyramid.

C. Make or use a skeleton of any prism. Sketch it.

D. Repeat Part C for a different prism.

Reflecting

1. Choose one of your sketches for a pyramid. Describe your strategy.

2. Repeat Question 1 for a prism.

3. Do your sketches show all the vertices? Why or why not?

B Sketching Models

Exploration

Materials	• skeleton models created for Lesson 3 • 3-D models • toothpicks • modelling clay

Assessment for Feedback	What You Will See Students Doing…	
Students will	**When Students Understand**	**If Students Misunderstand**
• sketch skeletons of 3-D models	• Students will be able to correctly sketch skeletons of 3-D models.	• Students may have problems sketching skeleton models. Guide them to do it step by step, focusing on each part by first identifying and then sketching. Ensure that they are aware of where each part is, relative to the other parts.

1. Introduction (Whole Class) ▸ 5–10 min

Display a variety of skeletons made for Lesson 3, along with their corresponding 3-D models. Have students compare them. Ask, "When you look at both types of models from one side, what can you see about the skeleton that you can't see in the 3-D model?"

2. Teaching and Learning (Whole Class/Pairs) ▸ 25–35 min

Draw attention to the central question in Lesson 11B and Pedro's strategies. Demonstrate the drawing process for both shapes on a transparency, on the board, or on chart paper. Ask, "What is the difference between drawing a pyramid and drawing a prism?" Students should note that all edges of Pedro's sketches are the same length because the toothpicks are the same length. Have students complete prompts A to D in pairs. Ensure that students realize that they can use Pedro's method or their own strategies to sketch each skeleton. Tell students that they may place the skeletons in any position they wish and sketch from any position. Students can sketch skeletons they made or skeletons created by classmates. If students are making new skeletons, have them use the 3-D models as guides.

Reflecting Use these questions to lead students to reflect on their strategies for sketching skeletons.

Sample Discourse

1. • *First I sketched the top vertex of the skeleton for a square-based pyramid. Then I sketched the edges that go from the top vertex to the base. Then I joined the vertices at the bottom of these edges to sketch the base. I made each edge the same length because all the toothpicks are the same length. This is different from Pedro's method.*

2. • *I figured out my own method. I looked at my skeleton model from the side and sketched all the edges that go up and down. I joined the bottom vertices of these edges to make the base. Then I joined the top vertices of the edges that go up and down to draw the top of the skeleton.*

• *I used Pedro's method. I sketched the base and the top of the skeleton. Then I joined vertices to draw the sides.*

3. • *Yes. For some drawings, I drew the vertices and then joined them to draw the edges. For other drawings, I drew each edge. The vertices are at the ends of the edges I drew.*

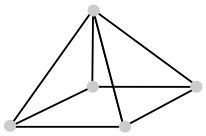
• *Yes. A skeleton is made of all the edges and vertices of a 3-D model, so, I sketched all the edges and vertices.*

3. Consolidation ▸ 5–10 min

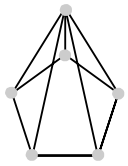
Closing (Whole Class) Ask, "How is drawing the skeleton of a prism different from drawing the skeleton of a pyramid? How is it the same? How does your sketch depend on the position of the model?"

Answers

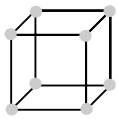
A. For example,



B. For example,



C. For example,



D. For example,

1.–3. See sample answers under Reflecting.

Math Background

Because the lesson calls for sketches, and a sketch is defined as a rough drawing, it is not necessary for students to make exact drawings. A close approximation will do.

CHAPTER 11

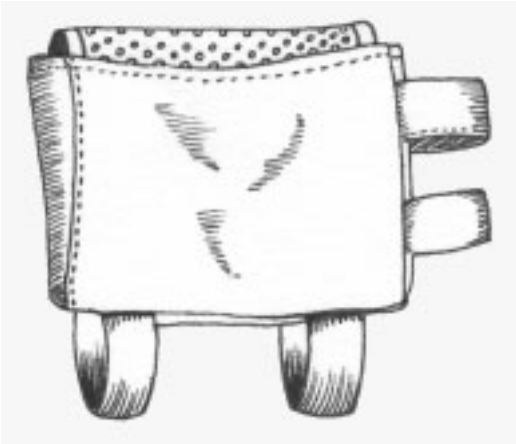
C Comparing Masses

You will need

- balance scales and masses

Goal **Choose units to measure and compare masses.**

Rami's bike pack goes over the back wheel of his bike with a pocket on each side. He wants to carry 2 books in each pocket and balance the bike as well as possible.



? How can Rami decide which books to put in each bag?

A. Choose 4 books.

B. Choose a unit: grams or kilograms. Estimate the mass of one book.

C. Choose a unit: **milligrams**, grams, or kilograms. Measure the mass of the book.

D. Repeat Parts B and C for your other books.

E. Order your books from the least to greatest mass.

F. Explain how Rami can decide which books to put in each pocket.

milligram (mg)
A unit for measuring mass
1000 mg = 1 g

Reflecting

1. Explain how you estimated the mass of a book.

2. Which are reasonable units for measuring and comparing masses of books: kilograms, grams, or milligrams? Explain.

C Comparing Masses

Exploration

Materials	• balance scales • masses

Assessment for Feedback	What You Will See Students Doing…	
Students will	**When Students Understand**	**If Students Misunderstand**
• be able to compare the masses of objects and choose units of mass	• Students will be able to correctly measure and compare the masses of objects and make reasonable choices about units of mass.	• Students may have difficulty estimating the masses of objects. Have them hold an object with a known mass in one hand and find another object that feels like about the same, greater, or less mass by holding it in the other hand.

1. Introduction (Whole Class) ▸ 5–10 min

Choose a small object. Ask students, "What do you think might have about the same mass as this?" Discuss how to check whether the two objects have the same mass. Demonstrate by placing the objects on either side of a set of balance scales. Emphasize that the aim is to find objects whose mass is close, not exactly the same.

2. Teaching and Learning (Whole Class/Pairs/Small Groups) ▸ 20–30 min

Discuss the situation at the top of Lesson 11C with students. Talk about what would make the bike balanced. Ensure that students understand that each pocket will have 2 of the 4 books. Read the central question. Talk about the unit *milligrams*. You might tell students that a grain of sand can have a mass of 13 mg. Have students complete prompts A to C in pairs or small groups. Then ask for some of the measurements. Emphasize that measurements are meaningless without units. Have students continue with prompts D to F. Discuss the results as a group. Invite a pair or small group to display their books in order from least to greatest mass, and then in the two groups as the books would be arranged in the pockets of the bike pack. Repeat this for other sets of four books.

Reflecting Here, students explain their thoughts about choosing units for estimating and measuring mass.

Sample Discourse

1. • *I remembered the mass of another object that I had measured was about 620 g. I held the book in my hand and thought that it was a little lighter, so I estimated its mass was about 600 g.*

2. • *My heaviest books each have a mass of about 1 kg. If I measure their masses as 1 kg, I can't compare them. I didn't measure any books whose mass was as great as 2 kg. My paperback novels are much less than 1 kg. So kilograms is not a reasonable unit for measuring and comparing masses of books.*

- *My paperback novels have masses of 90 g and 225 g. My heavier books have masses of 1250 g and 935 g. I can use these measurements to order their masses, so, grams are a reasonable unit for measuring and comparing masses of books.*
- *1 g = 1000 mg. Even the lightest books with a mass of 90 g would be a great number of milligrams. And I don't have masses for milligrams. A 1 g mass is tiny and very light. So, milligrams are not a reasonable unit for measuring and comparing masses of books.*

3. Consolidation ▸ 10–15 min

Closing (Whole Class) Remind students that 1 g = 1000 mg. Measure the weight of a light object such as a paper clip. If a 1 g mass is not available, place several paper clips on the balance scales so that the mass is 10 g. Discuss how to determine how many of the objects have a mass of about 1 g. For example, if 10 paper clips have a mass of 10 g, then 1 paper clip has a mass of 1 g. Have students find other objects that they think have a mass of about 1000 mg, for example, a thumbtack or an elastic.

Answers

B. For example, grams; about 200 g (Book A)

C. For example, grams; 180 g (Book A)

D. For example, grams; about 1 kg (Book B)
For example, grams; 1 kg 20 g (Book B)
For example, grams; about 400 g (Book C)
For example, grams; 451 g (Book C)
For example, grams; about 300 g (Book D)
For example, grams; 334 g (Book D)

E. For example, Book A, Book D, Book C, Book B

F. For example, Rami could put Book C and Book D on one side and Book A and Book B on the other side. The mass of the books in the 2 bags would be as close as possible for 2 books in each bag.

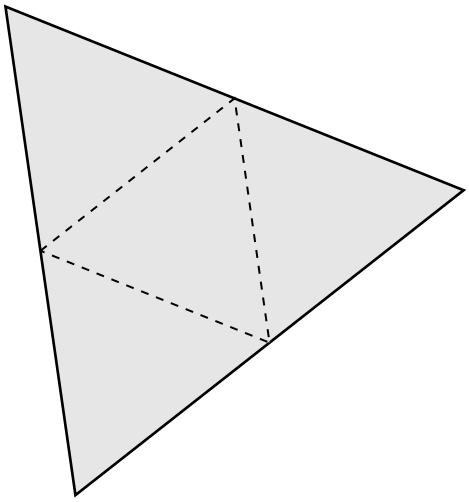
1.–2. See sample answers under Reflecting.

Chapter Review

LESSON

A

1. **a)** Use a net like this to make a 3-D shape.



b) Name the base of the 3-D shape.
c) Name the 3-D shape.

2. **a)** Use a 3-D model for a cube.
Create 2 different nets.
Use the nets to make the cube.
b) How are your nets the same? How are they different?

B

3. **a)** Choose a skeleton that you made for a pyramid.
Sketch the skeleton.
b) Describe your sketch.

4. **a)** Choose a skeleton that you made for a prism.
Sketch the skeleton.
b) Compare your sketch with the skeleton.

C

5. **a)** Choose 8 objects. Choose one of the objects that you think is not the heaviest or the lightest.
b) Measure the masses of the objects.
Sort the objects into 2 groups.
Place objects whose masses are less than the object you chose in part a) in one group and objects whose masses are greater than it in the other group.

6. Which unit would you use to describe the mass of each object: milligrams, grams, or kilograms? Explain.

a) a grain of salt
b) a CD
c) a ring
d) a snowflake
e) a feather
f) a chair

Chapter Review Lessons A, B, and C

Using the Chapter Review

Materials	• 3-D models • paper • stickers • scissors • skeleton models created for Lesson 3	• toothpicks • modelling clay • balance scales • masses
Masters	• Nets, Supplement, p. 112	

Use this supplemental review to assess students' understanding of the concepts developed in Lessons 11A, 11B, and 11C. All questions can be used for summative assessment.

2. Students may need guidance in drawing nets that can be folded to make a cube. Remind students about using stickers to mark faces of the 3-D model that they have traced, as in Lesson 11A.

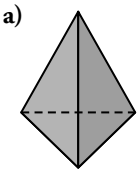
3.–4. Remind students that all edges of their sketch should be the same length because the toothpicks are the same length.

5. Make sure that students understand that the object that they are choosing must not be the lightest or the heaviest.

Ask	Possible Response
About **Question 3**: • How can you tell the difference between a pyramid and a prism?	• *A pyramid has a single vertex at the top where the faces meet. A prism has 2 congruent bases that are opposite each other.*
About **Question 5**: • How did you choose the object for part a)?	• *I held each object, one at a time, and chose a ruler because I know that some of the objects are lighter than it and some are heavier than it.*

Answers

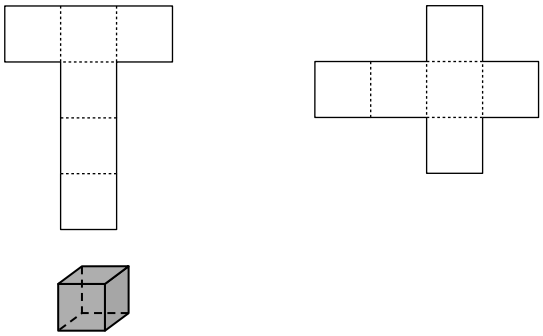
1. a)



b) triangle

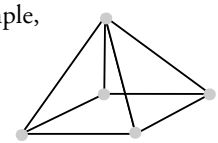
c) triangle-based pyramid

2. a) For example,



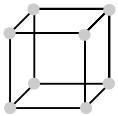
b) The nets are the same because each has 6 squares. Each net can be folded to form a cube. The nets are different because the squares are in different positions in each net.

3. a) For example,



b) For example, there are 5 faces, 8 edges and 5 vertices

4. a) For example,



b) For example, in my sketch, all of the edges are the same length because in the skeleton, all of the toothpicks are the same length. My sketch has the same number of edges and vertices as the skeleton.

5. a) For example, an eraser, a paper clip, scissors, a paperback novel, a calculator, a pen, a piece of paper, and a ruler
For example, the ruler is not the lightest or the heaviest.

b) For example, less than the mass of a ruler: a paper clip, an eraser, a piece of paper; greater than the mass of a ruler: a pen, a calculator, a paperback novel, scissors

6. a) milligrams; For example, its mass might be a few milligrams. Its mass is much lighter than 1 g.

b) grams; For example, its mass is much less than 1 kg and much greater than a few thousand milligrams.

c) grams; For example, it is much lighter than a 1 kg mass and heavier than a thousand milligrams.
milligrams; For example, its mass might be a few grams so it would be a few thousand milligrams.

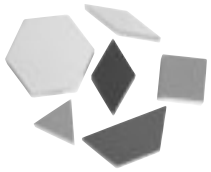
d) milligrams; For example, it is too light to be measured in grams.

e) milligrams; For example, it is too light to be measured in grams.

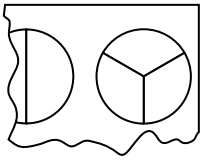
f) kilograms; For example, it is too heavy to be measured in grams.

You will need

- pattern blocks



- fraction circles



- pencil crayons

- linking cubes

Getting Started

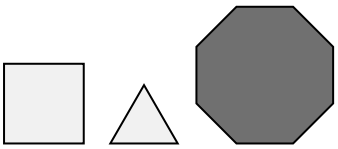
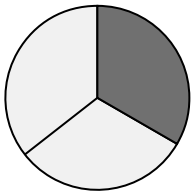
Fractions

? How can you show two thirds?

A. Look at the picture on page 322 of your textbook. Describe the students to show examples of the fraction two thirds.

B. Use materials to make as many models of two thirds as you can.

C. Work with a partner. Do your models show two thirds of a set or two thirds of a whole?

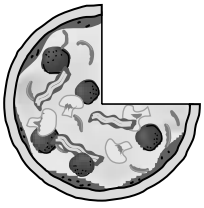
two thirds of a set	two thirds of a whole
	

D. Find things in your classroom that you can describe with fractions.

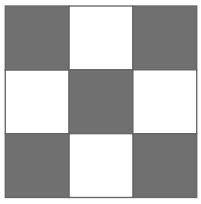
Do You Remember?

1. Which picture *cannot* be described by the fraction three fourths?

A.



B.



C.

CHAPTER 12

A Fractions of a Set

You will need

- counters

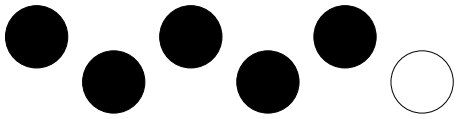
Goal **Describe fractions as parts of a set using words, objects, pictures, and symbols.**

Rey wants to send 5 invitations for a party. Some invitations are sold in boxes of 6, others are in boxes of 8, and others are in boxes of 10.

? What fraction of a box of invitations would Rey use?

Rey's Invitations

If I bought a box of 6, I'd use 5 of the 6 invitations.
I'll use counters to model the invitations.
I would use *five sixths* of them.



$\frac{5}{6}$ ← **numerator**
← **denominator**

A. How do the counters show that Rey would use $\frac{5}{6}$ of the invitations in a box of 6?

B. What fraction of a box of 6 invitations would Rey *not* use?

C. Use counters. Model the fraction of a box of 8 invitations Rey would use. Write the fraction for your model. Write the words for your model.

D. Repeat Part C for a box of 10 invitations.

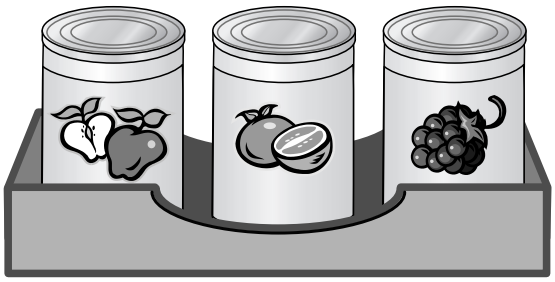
numerator
The number above the bar in a fraction that shows the number of parts the fraction represents

denominator
The number below the bar in a fraction that shows the number of parts in the whole

Reflecting

1. **a)** What does the numerator in the fraction for Part C show?
   b) What does the denominator show?
2. Would the size of the invitations change the fractions for Parts A to D? Why or why not?

Checking



3. A carton has 3 cans of juice.
   Rey needs 2 cans of juice for his party.
   Model the fraction of a carton he needs.
   Write the fraction and the words.

Practising

4. A bag has 12 balloons. Rey will use 11 balloons for his party.
   a) What fraction of the balloons in the bag will Rey use? Show your work.
   b) What fraction will Rey *not* use?

5. Rey bought a package of 9 noisemakers.
   He'll use 8 noisemakers for his party.
   Model the noisemakers.
   Sketch your model.
   What fraction of the package will he use?

6. Rey bought a package of 12 party favours.
   He'll give away $\frac{9}{12}$ of them.
   a) How many party favours will he give away? Draw a picture to explain your answer.
   b) How does your picture show what fraction of the party favours he will *not* give away?

7. Rey used a whole box of 8 party decorations.
   What fraction of the box did he use? How do you know?

A Fractions of a Set

Guided Activity

Materials	counters

Assessment for Feedback	What You Will See Students Doing…	
Students will	**When Students Understand**	**If Students Misunderstand**
• describe fractions as parts of a set using words, objects, pictures, and symbols	• Students will be able to correctly describe fractions as parts of a set using words, objects, pictures, and symbols.	• Students may have difficulty seeing the set of objects as one whole. Have them place counters of two different colours on a notebook and record the fractions. Emphasize that all the counters on the notebook belong to one group. Point out that when the total number of counters changes, the denominator changes. When the total stays the same but counters are traded for others of the different colours, the numerator changes.

1. Introduction (Whole Class) ▸ 5–10 min

Invite 5 students to stand. Ask, "What fraction of the students are wearing red? What fraction of the students have short hair?" Repeat this for a few other examples.

2. Teaching and Learning (Whole Class/Pairs) ▸ 25–35 min

Read about Rey's party invitations in Lesson 12A and the central question. Use counters to model the problem as in the art. Discuss the definition of numerator and denominator and prompt A. In pairs, have students complete prompts B to D.

Reflecting Here, students express their thoughts about fractions as part of a group and about modelling fractions.

Sample Discourse

1. a) • *The numerator tells that Rey would send 5 of the invitations in the box.*

b) • *The denominator tells that the number of invitations in a box is 8.*

2. • *No. The numerator tells the number of invitations Rey would send. The denominator tells the number of invitations in the box. The size of the invitations would not change this.*

3. Consolidation ▸ 20–30 min

Checking (Pairs)

3. Ask students to explain how the model, the fraction, and the words show the numerator and denominator.

Practising (Individual)

6. Use Assessment Tool 7, Masters Booklet, p. 8, to assess answers for this key assessment question.

Closing (Whole Class) Write a fraction on the board, for example, $\frac{3}{4}$. Ask students, "What sets do you see that model this fraction? Students might say that $\frac{3}{4}$ of the students at a table are wearing sweaters.

Answers

A. For example, 5 out of the 6 counters are black.

B. $\frac{1}{6}$

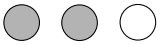
C. 

$\frac{5}{8}$; five eighths

D. 

$\frac{5}{10}$; five tenths

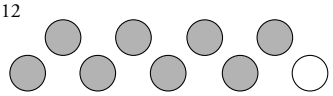
1.–2. See sample answers under Reflecting.

3. For example, 

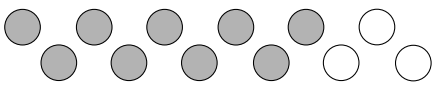
$\frac{2}{3}$; two thirds

4. 

a) $\frac{11}{12}$ **b)** $\frac{1}{12}$

5. For example, $\frac{8}{9}$ 

6. a) 9 party favours; For example,



b) For example, the circles are not coloured in.

7. $\frac{8}{8}$; For example, Rey used 8 out of 8, so the numerator is 8 and the denominator is 8.

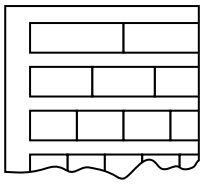
Math Background

Fractions describe parts of a whole (area) or parts of a set (group) of objects. The numerator is the counting number, or how many parts you are talking about. The denominator tells what is being counted, for example, thirds.

B Comparing Fractions

You will need

- fraction rectangles



- pencil crayons

Goal **Compare and order fractions.**

Chantal had some pieces of material to make a quilt. Each piece of material was the same size.

She used $\frac{2}{4}$ of the blue, $\frac{2}{5}$ of the green, $\frac{2}{10}$ of the yellow, and $\frac{2}{3}$ of the red.

? Which colour did Chantal use the most of?

Use fraction rectangles for Parts A to D.

A. Model the amount of the blue material Chantal used.

B. Repeat Part A for each of the other colours.

C. Order your models to show the colours Chantal used from least to greatest.

D. Order the fractions for your models from least to greatest.

E. Which colour did Chantal use the most of to make the quilt?

Reflecting

1. Why do you need to know Chantal's pieces of material were the same size? Include a drawing with your answer.

2. Which of your models shows the greatest fraction: the model with the most parts or the model with the fewest parts? How do you know?

3. Suppose the numerators are the same, for example, $\frac{1}{2}$, $\frac{1}{5}$, $\frac{1}{3}$, $\frac{1}{10}$, and $\frac{1}{4}$.

Which is greatest: the fraction with the greatest denominator or the fraction with the least denominator? How do you know?

B Comparing Fractions

Exploration

Materials	• pencil crayons
Masters	• Fraction Rectangles, Teacher's Resource, Chapter 12, p. 74

Assessment for Feedback	What You Will See Students Doing…	
Students will	**When Students Understand**	**If Students Misunderstand**
• compare and order fractions with the same numerator	• Students will be able to correctly compare and order fractions with the same numerator.	• Students may have difficulty comparing and ordering the fractions. Have them colour the same number of parts for rectangles that have 2, 3, 4, 5, and 10 parts. Help them place one rectangle over another to compare. Ask which rectangle has a larger amount that is coloured and which has the most parts. Repeat this for different numerators.

1. Introduction (Whole Class) ▸ 5–10 min

Fold a piece of paper in half so that there is only one part showing. Take another piece of paper that is the same size and fold it into quarters, with only one part showing. Ask, "Which gives more paper to write on?" Unfold each piece of paper, and discuss how many parts each piece was divided into.

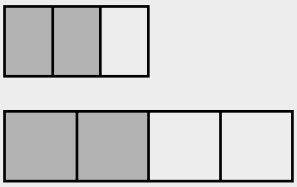
2. Teaching and Learning (Whole Class/Pairs) ▸ 25–35 min

Together, read the problem in Lesson 12B. Ask students to explain the information in their own words. Point out that while the fractions have the same numerator, the denominators are different. Ensure that they realize that each piece of material was the same size. Read the central question. Have students answer prompts A to D in pairs. Discuss the answers as a class. Ask, "What do you notice about the denominator as you go from the least to the greatest fraction?" Have students complete prompt E in pairs.

Reflecting Use these questions to lead students to discuss comparing and ordering fractions with the same numerator.

Sample Discourse

1. • *If Chantal's piece of material for fourths was larger than her piece of material for thirds, two fourths of her larger piece of material might be more than two thirds of her smaller piece of material.*



2. • *My model with the fewest parts shows the greatest fraction. When you divide something into more parts, each part is smaller. If you shade the same number of parts in different models of the same size, then the model with the biggest parts will show the greatest fraction.*

3. • *The fraction with the least denominator is greatest because the denominator shows the number of parts something is divided into. When you have more parts, each part is smaller. Since all the fractions have the same numerator, which is 1, the fraction with the smallest denominator is the greatest.*

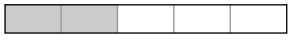
3. Consolidation ▸ 10–15 min

Closing (Whole Class) Choose two fractions with the same denominator but different numerators. Ask, "Which is greater? Why?" Use models to show this. Choose two fractions with the same numerator but different denominators, using two of the denominators 2, 3, 4, 5, and 10. Ask, "Which is greater? How do you know?" Use models. Repeat this a few times.

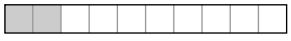
Answers

A. Blue material:

B. Green material:



Yellow material:



Red material:

C. yellow, green, blue, red

D. $\frac{2}{10}, \frac{2}{5}, \frac{2}{4}, \frac{2}{3}$

E. red

1.–3. See sample answers under Reflecting.

Math Background

In this lesson, all the numerators are the same for each comparison; that is, in each model, the number of parts being counted is the same. It is the denominator that changes. In Lesson 12.1, students compared and ordered fractions with the same denominators but different numerators.

CHAPTER 12

C Equivalent Fractions

Goal **Represent and name equivalent fractions, and compare fractions to 0, $\frac{1}{2}$, and 1.**

Manitok and Sarah are making a comic book together.

Manitok says they finished $\frac{4}{6}$ of their comics.

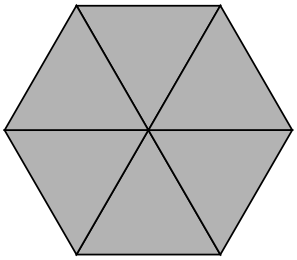
He says that's closer to $\frac{1}{2}$ than to 1.

Sarah says they finished $\frac{2}{3}$ of their comics.

? Are Manitok and Sarah both correct?

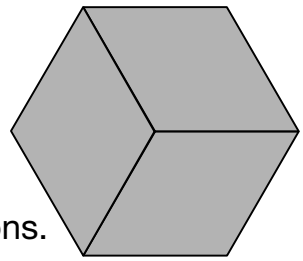
Manitok's Pattern Blocks

I'll use pattern blocks.
I can cover a hexagon with 6 triangles.
4 of the 6 triangles model $\frac{4}{6}$.



I can cover the 6 triangles with 3 rhombuses.

2 of the 3 rhombuses model $\frac{2}{3}$.



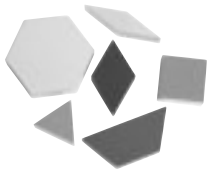
2 rhombuses cover the same amount of the hexagon as 4 triangles.

So $\frac{2}{3}$ and $\frac{4}{6}$ are **equivalent** fractions.

$\frac{2}{3} = \frac{4}{6}$

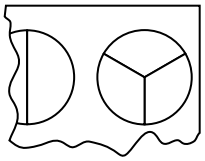
You will need

- pattern blocks



- counters

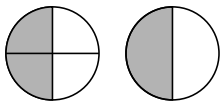
- fraction circles



- pencil crayons

equivalent fractions

Fractions that represent the same part of a whole or the same part of a set



$\frac{2}{4}$ $\frac{1}{2}$

$\frac{2}{4}$ is equivalent to $\frac{1}{2}$.

$\frac{2}{4} = \frac{1}{2}$

I can cover a hexagon with 2 trapezoids.

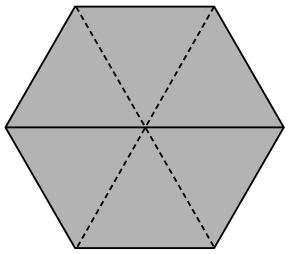
1 of the 2 trapezoids models $\frac{1}{2}$.

1 trapezoid covers the same amount of the hexagon as 3 triangles.

So $\frac{3}{6} = \frac{1}{2}$. 6 of the 6 triangles model $\frac{6}{6}$.

I can see that $\frac{4}{6}$ is closer to $\frac{3}{6}$ than to $\frac{6}{6}$.

So $\frac{4}{6}$ or $\frac{2}{3}$ is closer to $\frac{1}{2}$ than to 1.



Reflecting

1. Explain how you know that $\frac{2}{3}$ is closer to $\frac{1}{2}$ than to 1.

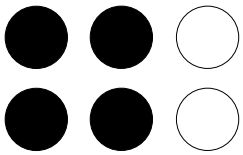
2. a) How does Manitok's model show that $\frac{2}{6}$ is equivalent to $\frac{1}{3}$?

b) How does it show that $\frac{1}{3}$ is closer to $\frac{1}{2}$ than to 0?

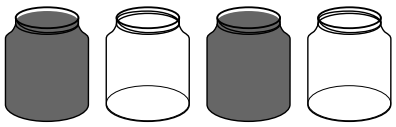
Checking

3. Write 2 equivalent fractions for each picture.

a)



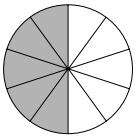
b)



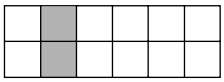
Practising

4. Write 2 equivalent fractions for the grey part.

a)



b)



5. Use models to write an equivalent fraction for each. Sketch your models. Tell whether each pair of equivalent fractions is closer to 0, $\frac{1}{2}$, or 1.

a) $\frac{2}{5}$ **b)** $\frac{8}{10}$

C Equivalent Fractions

Direct Instruction

Materials	• pattern blocks • counters • pencil crayons
Masters	• Fraction Circles, Teacher's Resource, Chapter 12, p. 73

Assessment for Feedback	What You Will See Students Doing…	
Students will	**When Students Understand**	**If Students Misunderstand**
• represent and name equivalent fractions and compare fractions to 0, $\frac{1}{2}$, and 1	• Students will be able to correctly represent, name, and compare equivalent fractions to 0, $\frac{1}{2}$, and 1.	• Students may have difficulty representing equivalent fractions. Help them line up counters in rows to show the equivalent fractions.

1. Introduction (Whole Class) ▸ 5–10 min

Draw two pizzas on the board. Divide the first one into halves. Divide the second one into quarters. Shade one half of the first pizza and two quarters of the second pizza. Ask the students which one they would rather have.

2. Teaching and Learning (Whole Class/Pairs) ▸ 15–20 min

As a class, read in Lesson 12C about making comics. Then read the central question. Have students work in pairs with pattern blocks to model the way Manitok covered a hexagon with triangles, and then rhombuses. Refer to the definition of equivalent fractions. Continue for covering a hexagon with trapezoids and relating 1 trapezoid to 3 triangles.

Reflecting These questions encourage students to reflect on the relationship between equivalent fractions and strategies for determining whether a fraction is closer to 0, $\frac{1}{2}$, or 1.

Sample Discourse

1. • *I can model $\frac{2}{3}$ with 2 blue rhombuses. I can model $\frac{1}{2}$ with a red trapezoid and 1 with a yellow hexagon. From that, I can see that $\frac{2}{3}$ is closer to $\frac{1}{2}$ than to 1.*

2. a) • *2 of Manitok's 6 triangles model $\frac{2}{6}$. 1 of his 3 rhombuses models $\frac{1}{3}$. 2 triangles cover the same amount of a hexagon as 1 rhombus. So $\frac{2}{6}$ is equivalent to $\frac{1}{3}$.*

b) • *2 of the 6 triangles model $\frac{1}{3}$ or $\frac{2}{6}$. 3 of the 6 triangles model $\frac{1}{2}$. 0 triangles model $\frac{0}{6}$ or 0. I can see from models that $\frac{1}{3}$ is closer to $\frac{1}{2}$ than to 0.*

3. Consolidation ▸ 20–30 min

Checking (Pairs)

3. Encourage students who are having difficulty to use counters to model fractions.

Practising (Individual)

5. Use Assessment Tool 7, Masters Booklet, p. 8, to assess answers for this key assessment question.

Closing (Whole Class) Ask a question about whole months, such as, "How many months of the school year have passed already? What fraction of the total number of months in a year is that? What is an equivalent fraction for the same number of months?" Model answers using counters. Depending on the time of year, ask, "Are we closer to the beginning of the year, 0, or halfway through, $\frac{1}{2}$?" Or, "Are we closer to halfway through the year, $\frac{1}{2}$, or the end of the year, 1?" Continue with other situations related to students' lives.

Answers

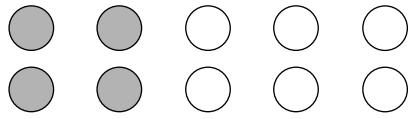
1.–2. See sample answers under Reflecting.

3. a) $\frac{4}{6}, \frac{2}{3}$ **b)** $\frac{2}{4}, \frac{1}{2}$

4. a) $\frac{5}{10}, \frac{1}{2}$ **b)** $\frac{2}{12}, \frac{1}{6}$ **c)** $\frac{6}{8}, \frac{3}{4}$

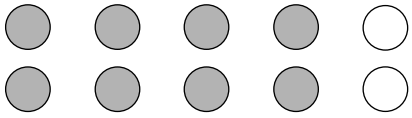
5. a) $\frac{2}{5}, \frac{4}{10}$; closer to $\frac{1}{2}$

For example,



b) $\frac{8}{10}, \frac{4}{5}$; closer to 1

For example,



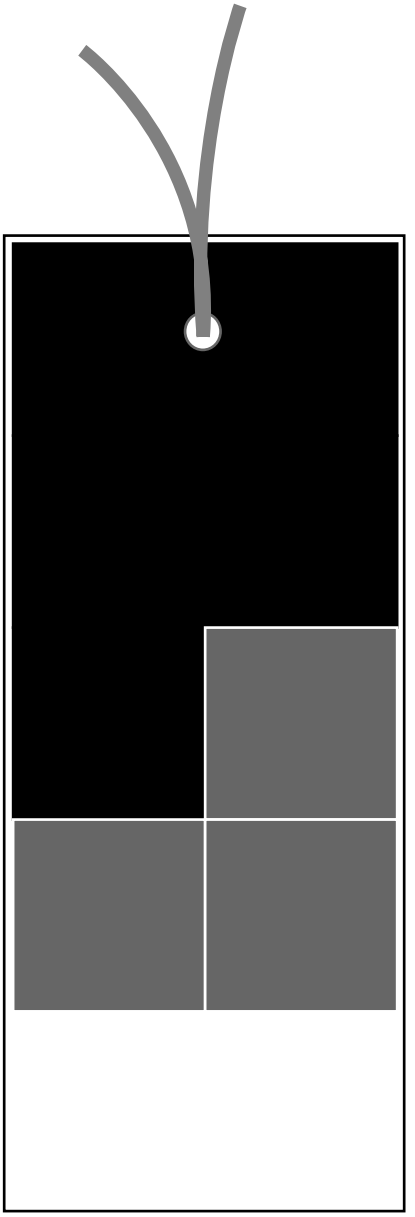
D Relating Fractions and Decimals

You will need

- pattern blocks

Goal **Explore the relationship between fractions and decimals.**

Zola created this bookmark.



? What fractions and decimals describe each colour?

Place pattern blocks on the bookmark.

A. What fraction of the bookmark is grey? What decimal part of it is grey?

B. Write 2 equivalent fractions for the white part of the bookmark. Write a decimal for the white part.

C. Repeat Part B for the black part of the bookmark.

Reflecting

1. Describe your strategy for figuring out the fractions and the decimal in Part C.

2. How is the meaning of 7 in $\frac{7}{10}$ and in 0.7 the same?

3. How is the meaning of 1 in $\frac{1}{2}$ and 0.1 different?

D Relating Fractions and Decimals

Exploration

Materials	• pattern blocks (squares)
Masters	• (manipulatives substitute) Pattern Block Shapes (squares), Masters Booklet, p. 38

Assessment for Feedback	What You Will See Students Doing…	
Students will	**When Students Understand**	**If Students Misunderstand**
• explore the relationship between fractions and decimals	• Students will understand the relationship between fractions with denominators of 2, 5, and 10 and decimals.	• Students may have difficulty going from fractions with denominators of 2 and 5 to equivalent fractions with denominators of 10 in order to express them as decimal tenths. Have them model the equivalent fraction using other materials, such as counters.

1. Introduction (Whole Class) ▸ 5 min

Sketch a number line for $\frac{0}{10}$ to $\frac{10}{10}$ on the board. Ask students to write a decimal on this number line below each fraction.

To emphasize the relationship between fractions and decimals, point out that the fraction and the decimal have the same name, for example, three tenths.

2. Teaching and Learning (Whole Class/Pairs) ▸ 35–45 min

Direct students' attention to Zola's bookmark in Lesson 12D. As a class, read the central question. Have pairs complete prompts A to C. If necessary, help them figure out how square pattern blocks fit exactly on the sections of the bookmark. Discuss responses as a class. Ask, "How is it helpful to determine an equivalent fraction with a denominator of 10 in Parts B and C before writing the decimal?"

Reflecting These questions lead students to relate fractions with denominators of 2, 5, and 10 to decimals.

Sample Discourse

1. • *I put square pattern blocks over the black part of the bookmark. I saw that 5 square pattern blocks fit exactly on the black part of the bookmark, and 10 square pattern blocks fit exactly on the whole bookmark. That means that $\frac{5}{10}$ of the bookmark is black. The decimal 0.5 equals $\frac{5}{10}$. There are as many square pattern blocks on the black part as there are on other colours. So $\frac{1}{2}$ of the bookmark is black.*

2. • *The 7 in $\frac{7}{10}$ and the 7 in 0.7 both mean 7 of 10 equal parts or 7 tenths.*

3. • *The 1 in $\frac{1}{2}$ means 1 of 2 equal parts. The 1 in 0.1 means 1 of 10 equal parts, or 1 tenth.*

3. Consolidation ▸ 5 min

Closing (Whole Class) Ask students to look for sets of 10 objects in the classroom. Have them write fractions with the denominator 10, and if possible, the denominator 2 or 5, for example, $\frac{4}{10}$ and $\frac{2}{5}$, on the board. Ask them to say the decimals.

Answers

A. $\frac{3}{10}$; 0.3

B. $\frac{2}{10}$, $\frac{1}{5}$; 0.2

C. $\frac{5}{10}$, $\frac{1}{2}$; 0.5

1.–3. See sample answers under Reflecting.

Math Background

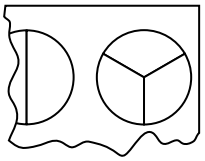
Students were introduced to decimal tenths in Lesson 4. In Lesson 12D, students further explore the relationship between fractions and decimals. You might discuss that any decimal written to the tenth place can be expressed as a fraction with the denominator 10.

CHAPTER 12

E Counting Patterns

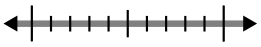
You will need

- fraction circles



- base ten blocks

- number lines



Goal **Use models to count forward and backward for fractions and for decimals.**

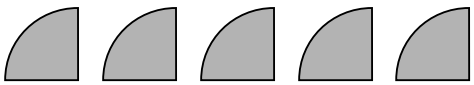
? How can you show counting patterns?

Mandy's Counting Pattern

I'll write a fraction pattern with this pattern rule:
Start with one fourth and count forward by fourths.

I can use fraction circles for fourths to model my pattern.

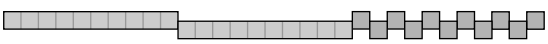
I'll count one fourth, two fourths, three fourths, four fourths, five fourths, ….



Josef's Counting Pattern

I'll write a decimal pattern with this pattern rule:
Start with 2.8 and count forward by tenths.

I can use base ten blocks to model my pattern.
I'll model 2.8, then I'll count 2.8, 2.9, 3.0, 3.1, ….



A. Model Mandy's pattern and extend it for 5 more terms. Write the words for these 5 fractions.

B. Start with the last fraction in Part A and count backward by fourths. Write the fractions.

C. Use base ten blocks to show Josef's pattern. Extend the pattern to 4.1. Write the decimals.

D. Start with 4.1 and count backward by tenths to 3.5. Write the decimals.

Reflecting

1. How can you use a number line to count forward for Mandy's pattern?

2. How can you use a number line to count backward for Josef's pattern?

Checking

3. a) Use a model. Start with one half and count forward by halves to eight halves. Write the words.

b) Start with eight halves and count backward by halves. Write the words for the 1st 3 fractions.

4. a) Use a model. Start with 1.7 and count by tenths to 2.9. Write the decimals. Did you count forward or backward?

b) Start with 2.9 and count by tenths to 2.4. Write the decimals.

Practising

Use models for Questions 5 to 7.

5. Start with one tenth and count forward by tenths to fifteen tenths. Write the words you count.

6. Start with 0.9 and count by tenths to 2.3. Write the decimals you count.

7. a) Start with one third and count by thirds to eleven thirds. Write the words.

b) Start with eleven thirds and count backward by thirds. Write the words for the first 3 fractions.

E Counting Patterns

Guided Activity

Materials	• base ten blocks
Masters	• Fraction Circles, Teacher's Resource, Chapter 12, p. 74 • Number Lines, Masters Booklet, p. 32 • (manipulatives substitute) Base Ten Blocks (tens and ones): Masters Booklet, pp. 33–34

Assessment for Feedback	What You Will See Students Doing…	
Students will	**When Students Understand**	**If Students Misunderstand**
• use models to count forward and backward for fractions and decimals	• Students will be able to correctly count forward and backward for fractions and decimals.	• If students are having difficulty, have them write word names for fractions with the denominator 5 on a number line, point to the fraction, and name the fraction. Have them count both forward and backward. Use a similar approach for fractions with the denominator 2 and the denominator 10.

1. Introduction (Whole Class) ▸ 5–10 min

As a class, have students review counting patterns by counting by 2s, 5s, and 10s.

2. Teaching and Learning (Whole Class/Pairs) ▸ 15–20 min

As a class, read the central question in Lesson 12E. Direct attention to Mandy's Counting Pattern. Discuss how each fourth of a fraction circle means the fraction in the pattern increases by one fourth. Continue to Josef's Counting Pattern. Ask, "How do the base ten blocks show the starting number? How do they show the counting pattern?" Talk about how each cube means that the decimal in the pattern increases by one tenth. Discuss prompts A and B. Ensure that students write the word names for the fractions since improper fractions and mixed numbers are not introduced. Have students complete prompts C and D, and discuss the answers as a class.

Reflecting Here, students reflect on strategies for counting forward and backward for fractions and decimals.

Sample Discourse

1. *I could mark a number line to show fourths and count one fourth, two fourths, three fourths, and so on.*

2. *I could mark a number line to show the decimals from 0 to 4.1 and count 4.1, 4.0, 3.9, 3.8, 3.7, 3.6, 3.5.*

3. Consolidation ▸ 20–30 min

Checking (Pairs)

3. Make sure that students are counting in the right direction, that is, forward or backward.

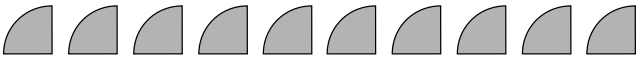
Practising (Individual)

7. Use Assessment Tool 8, Masters Booklet, p. 9, to assess answers for this key assessment question.

Closing (Whole Class) Have a student start counting by halves from seven halves to three halves. Ask, "Did you count forward or backward? How do you know?" Continue for other fractions with denominators of 2, 3, 4, and 10.

Answers

A.



six fourths, seven fourths, eight fourths, nine fourths, ten fourths

B. ten fourths, nine fourths, eight fourths, seven fourths, six fourths, five fourths, four fourths, three fourths, two fourths, one fourth

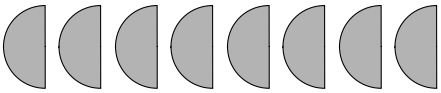
C.

3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 4.0, 4.1

D. 4.1, 4.0, 3.9, 3.8, 3.7, 3.6, 3.5

1.–2. See sample answers under Reflecting.

3. a)



one half, two halves, three halves, four halves, five halves, six halves, seven halves, eight halves

b) eight halves, seven halves, six halves

4. a) 1.7, 1.8, 1.9, 2.0, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9; forward

b) 2.9, 2.8, 2.7, 2.6, 2.5, 2.4

5. one tenth, two tenths, three tenths, four tenths, five tenths, six tenths, seven tenths, eight tenths, nine tenths, ten tenths, eleven tenths, twelve tenths, thirteen tenths, fourteen tenths, fifteen tenths

6. 0.9, 1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 2.0, 2.1, 2.2, 2.3

7. a) one third, two thirds, three thirds, four thirds, five thirds, six thirds, seven thirds, eight thirds, nine thirds, ten thirds, eleven thirds

b) eleven thirds, ten thirds, nine thirds

LESSON

Skills Bank

A

1. What fraction of each set is black?

a) ● ● ● ○ ○

b) ● ● ○

c) ● ● ● ● ● ● ● ○ ○ ○

2. Write the fraction for each.

a) three fourths **b)** three eighths **c)** one half

B

3. Which fraction is greater?

a) $\frac{1}{2}$ or $\frac{1}{3}$ **b)** $\frac{4}{5}$ or $\frac{4}{10}$ **c)** $\frac{3}{4}$ or $\frac{3}{5}$ **d)** $\frac{2}{5}$ or $\frac{2}{3}$

4. Order the fractions from least to greatest.

a) $\frac{3}{5}$, $\frac{3}{4}$, $\frac{3}{10}$ **b)** $\frac{1}{5}$, $\frac{1}{3}$, $\frac{1}{10}$, $\frac{1}{4}$

C

5. Think of a yellow hexagon pattern block as the whole.

a) What fraction of the hexagon is 2 green triangle pattern blocks?
Write 2 equivalent fractions for your answer.

b) What fraction of the hexagon is 1 red trapezoid pattern block? Write 2 equivalent fractions for your answer.

6. Tell whether each fraction is closer to 0, $\frac{1}{2}$, or 1

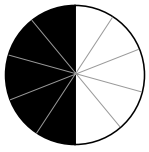
a) $\frac{1}{10}$ **b)** $\frac{4}{10}$ **c)** $\frac{5}{6}$ **d)** $\frac{3}{5}$

7. Are half the counters black? How do you know?

● ● ● ● ○ ○ ○

D

8. Write 2 fractions and a decimal for the black part.



E

9. Use a model. Start with one half and count forward by halves to seven halves. Write the words you count.

10. a) Use a model. Start with 0.6 and count to 1.8.
Write the decimals. Did you count forward or backward?

b) Start with 1.8 and count to 1.0. Write the decimals.

Skills Bank Lessons A, B, C, D, and E

Using the Skills Bank

Materials	• counters • pencil crayons • pattern blocks
Masters	• Fraction Circles, Teacher's Resource, Chapter 12, p. 73 • Fraction Rectangles, Teacher's Resource, Chapter 12, p. 74 • Number Lines, Masters Booklet, p. 32 • (manipulatives substitute) Pattern Blocks, Masters Booklet, p. 38

Make materials from the lessons available to students as they complete the questions.

3. Encourage students who have difficulties to use fraction rectangles.

Answers

1. a) $\frac{3}{5}$

b) $\frac{2}{3}$

c) $\frac{7}{10}$

2. a) $\frac{3}{4}$

b) $\frac{3}{8}$

c) $\frac{1}{2}$

3. a) $\frac{1}{2}$ **b)** $\frac{4}{5}$ **c)** $\frac{3}{4}$ **d)** $\frac{2}{3}$

4. a) $\frac{3}{10}, \frac{3}{5}, \frac{3}{4}$

b) $\frac{1}{10}, \frac{1}{5}, \frac{1}{4}, \frac{1}{3}$

5. a) $\frac{2}{6}, \frac{1}{3}$

b) $\frac{1}{2}, \frac{3}{6}$

6. a) closer to 0

b) closer to $\frac{1}{2}$

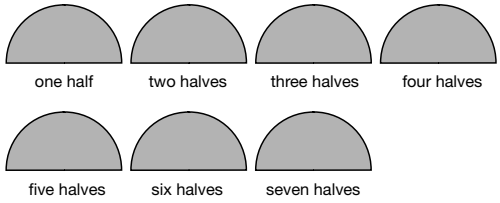
c) closer to 1

d) closer to $\frac{1}{2}$

7. No. $\frac{4}{7}$ of the counters are black and $\frac{4}{7}$ is not equivalent to $\frac{1}{2}$.

8. For example, $\frac{1}{2}, \frac{5}{10}$; 0.5

9. For example,



10. a) For example,

Forward

b) 1.8, 1.7, 1.6, 1.5, 1.4, 1.3, 1.2, 1.1, 1.0

Chapter Review

LESSON

A

1. Sketch a model for part of a set for each fraction.
a) $\frac{1}{2}$ **b)** $\frac{3}{4}$ **c)** $\frac{5}{6}$

2. Write the words for each fraction.
a) $\frac{2}{3}$ **b)** $\frac{4}{10}$ **c)** $\frac{1}{8}$

B

3. Terry wrote $\frac{2}{3}$, $\frac{2}{4}$, $\frac{2}{5}$, $\frac{2}{10}$. Did Terry order the fractions from least to greatest or from greatest to least?

C

4. Tell whether each fraction is closer to 0, $\frac{1}{2}$, or 1.
a) $\frac{4}{5}$ **b)** $\frac{3}{8}$ **c)** $\frac{9}{10}$

5. Vinh said, "I walked $\frac{8}{10}$ of the distance and Allison walked $\frac{4}{5}$ of it. So I walked farther."
Do you agree with Vinh? Why or why not?

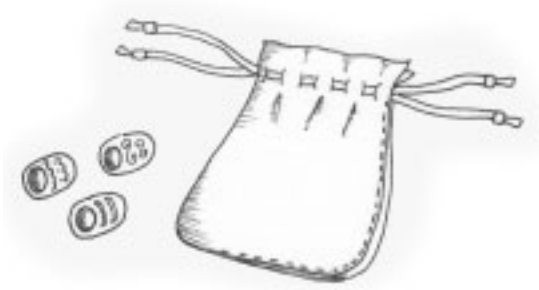
6. Jon gave each person half the beads from the bag.
He gave each person 3 beads.
How many beads were in the bag?
Use a model to show the answer.

D

7. Write each fraction as a decimal.
a) $\frac{7}{10}$ **b)** $\frac{4}{5}$ **c)** $\frac{2}{5}$ **d)** $\frac{1}{2}$

E

8. **a)** Use a model. Start with one fourth and count by fourths to nine fourths. Write the words.
b) Start with nine fourths and count backward by fourths.
Write the words for the first 3 fractions you count.



9. Use a model. Start with 4.8 and count by tenths to 7.0.
Write the decimals. Did you count backward? Explain.

Chapter Review Lessons A, B, C, D, and E

Using the Chapter Review

Materials	• counters • pencil crayons
Masters	• Fraction Circles, Teacher's Resource, Chapter 12, p. 73 • Fraction Rectangles, Teacher's Resource, Chapter 12, p. 74 • Number Lines, Masters Booklet, p. 32

Use this supplemental review to assess students' understanding of the concepts developed in Lessons 12A, 12B, 12C, 12D, and 12E. All questions can be used for summative assessment.
Make materials from the lessons available to students as they complete the questions.

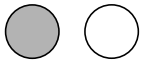
3. Students can model the fractions with fraction rectangles.

6. If students need assistance modelling this question, have them model the 3 beads for each person as shown in the picture. Ask, "How many people are sharing the beads if each gets half?" Lead students to realize why 2 people would be sharing the beads. If necessary, have students experiment with counters to show the number of beads in the bag until each has half.

Related Questions to Ask

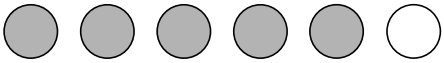
Ask	Possible Response
About **Question 5**: • What other question can you make that has an answer like this? Explain your thinking.	• *Vinh said, "I walked one half the distance and Allison walked two fourths of it. So I walked farther." Do you agree with Vinh? Why or why not?* • *One half and two fourths are equivalent fractions so they represent the same amount of the distance.*

Answers

1. a) For example, 

b) For example,

c) For example,



2. a) two thirds
b) four tenths
c) one eighth

3. from greatest to least; For example, thirds are greater than fourths, fourths are greater than fifths, an fifths are greater than tenths.

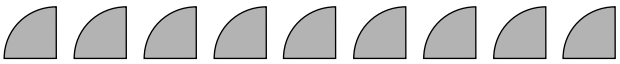
4. a) closer to 1 **b)** closer to $\frac{1}{2}$ **c)** closer to 1

5. No; For example, $\frac{8}{10}$ is equivalent to $\frac{4}{5}$, so they walked the same distance.

6. 6 beads

7. a) 0.7 **b)** 0.8 **c)** 0.4 **d)** 0.5

8. a) For example,



one fourth, two fourths, three fourths, four fourths, five fourths, six fourths, seven fourths, eight fourths, nine fourths

b) nine fourths, eight fourths, seven fourths

9. For example,

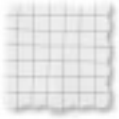
4.8, 4.9, 5.0, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 6.0, 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 7.0; No; For example, the decimals are increasing.

CHAPTER 14

A Reflection Patterns

You will need

- grid paper



- a ruler
- tracing paper
- dot paper

- a transparent mirror

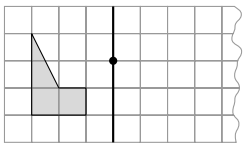
Goal **Describe and create reflection patterns.**

Paulette wants to make a reflection pattern for across a bulletin board.

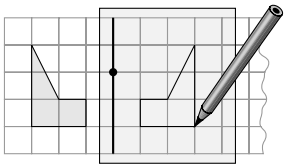
? How can Paulette make her reflection pattern?

Paulette's Pattern

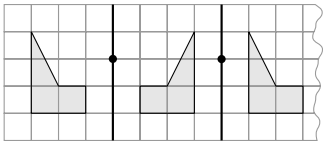
I'll start by drawing a shape. Then I'll draw a vertical line of reflection. I'll mark a point on the line of reflection.



I'll trace the shape, line of reflection, and point. Next, I'll flip my tracing so the line of reflection and the point on the tracing match the drawing. I'll mark the vertices.



I can take away the tracing and use the marks to draw the reflection of the shape. Then I'll draw the next reflection line.



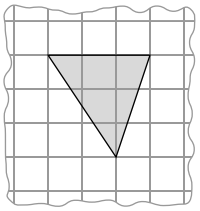
A. Predict the next shape in Paulette's pattern. Sketch your prediction.

B. Copy Paulette's pattern on grid paper or dot paper. Continue it by reflecting the shape 3 more times.

Reflecting

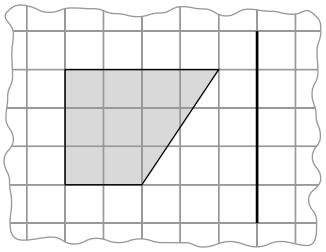
1. Explain how you made your prediction for Part A.
2. All the polygons in a reflection pattern are congruent. Explain how you know they are congruent.
3. Paulette's pattern can be created with a transparent mirror instead of tracing paper. Explain or show how.

Checking



4. **a)** Copy the triangle on grid paper. Draw a line reflection. Create a reflection pattern with 3 triangles.
   b) Describe your pattern.

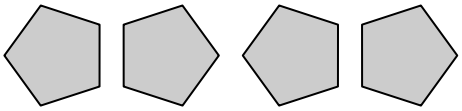
Practising



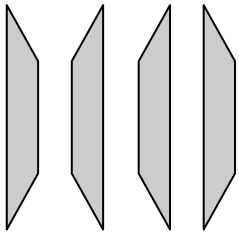
5. Copy the quadrilateral and line of reflection on grid paper. Create a reflection pattern with 5 quadrilaterals.

6. Does each pattern use reflections? How do you know?

   a)



   b)



7. **a)** Create your own reflection pattern with 5 shapes. Use grid paper or dot paper.
   b) Describe your pattern.

A Reflection Patterns

Guided Activity

Materials	• tracing paper • transparent mirrors • rulers • (optional) pattern blocks
Masters	• 1 cm Square Dot Paper, Masters Booklet, p. 25 • 1 cm Grid Paper, Masters Booklet, p. 23

Assessment for Feedback	What You Will See Students Doing…	
Students will	**When Students Understand**	**If Students Misunderstand**
• describe and create reflection patterns	• Students will reflect a shape to create reflection patterns.	• Students may have difficulty adjusting the position of the tracing after flipping it. Have them mark two dots on the line of reflection, and trace these two dots. Help them match the tracing with the dots.

1. Introduction (Whole Class) ▸ 5–10 min

Use large cardboard trapezoids or trapezoid pattern blocks to present a reflection pattern. Ask students to describe the pattern. Then place a trapezoid over the trapezoid at the left and ask a student to flip it to the next trapezoid. Discuss the motion.

2. Teaching and Learning (Whole Class/Pairs) ▸ 15–20 min

Read the problem and central question in Lesson 14A. Provide grid paper, rulers, and tracing paper, and have students work through Paulette's Pattern together. Have students complete prompts A to C in pairs.

Reflecting Students discuss their understanding of reflections.

Sample Discourse

1. • *I figured out that the next shape would look like the first shape Paulette drew because they flip back and forth.*

2. • *Each shape is made by using a tracing of the first shape, so all the shapes must be the same size and shape. That means they are congruent.*

3. • *You can place a transparent mirror along a line of reflection and draw the reflection.*

3. Consolidation ▸ 20–30 min

Checking (Pairs)

4. Students may need help drawing the lines of reflection. Their reflection patterns may vary according to the placement of the line of reflection.

Practising (Individual)

Students may need to tape sheets of grid paper together to make their reflection patterns.

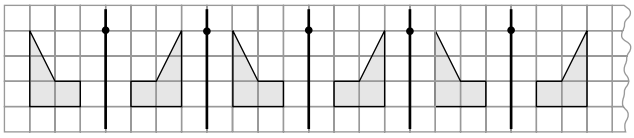
5. Use Assessment Tool 8, Masters Booklet, p. 9, to assess answers for this key assessment question.

Closing (Whole Class) Ask students whether they prefer to draw reflection patterns using tracing paper or a transparent mirror. Ask them to give reasons for their preferences.

Answers

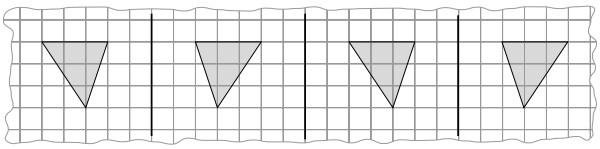
A. For example, I predict that the next shape will face the opposite way as the first shape.

B.



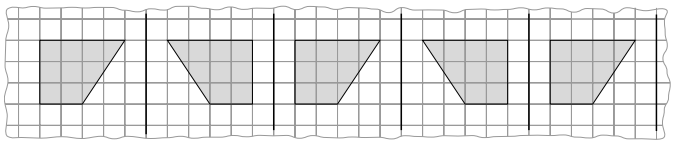
1.–3. See sample answers under Reflecting.

4. a) For example,



b) For example, each shape in the pattern is the same size and shape, but face in opposite directions from each other.

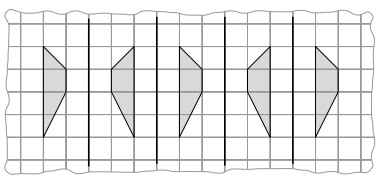
5.



6. a) Yes. For example, each pentagon is a reflection of the pentagon to its left.

b) No. The 2nd shape is a reflection of the 1st shape, but the 3rd shape is not a reflection of the 2nd shape.

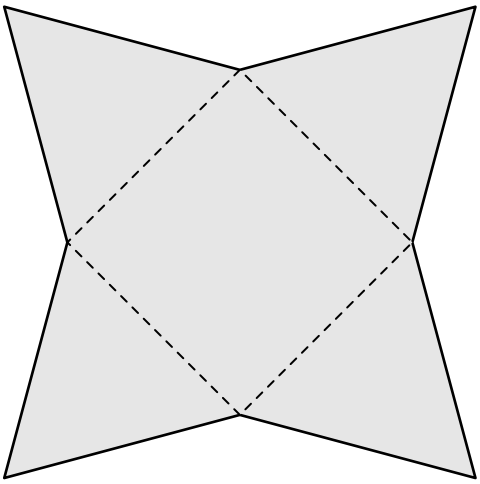
7. a) For example,

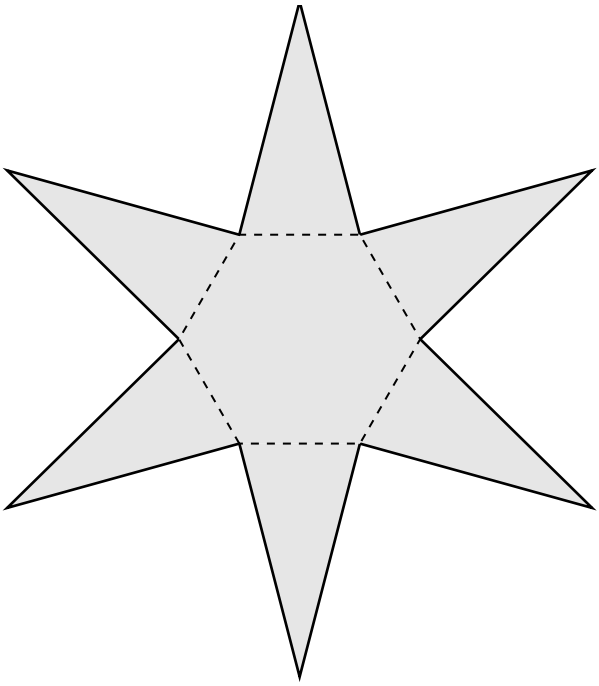


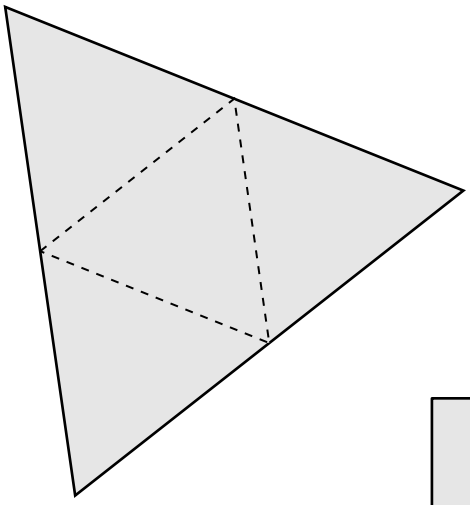
b) My pattern shows a shape flipped over a line of reflection 4 times. Each shape faces the opposite way to the shape before and after it. All the shapes in my pattern are congruent.

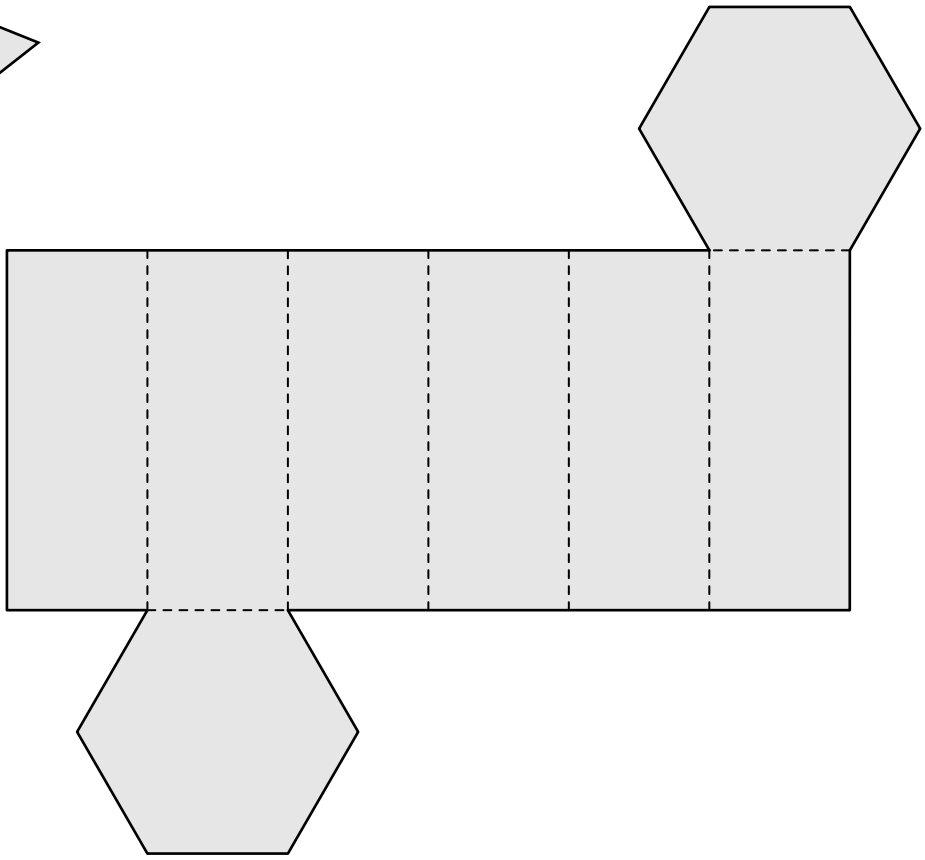
Nets

Lesson A: Designing Nets









Answers

Lesson 1A Answers (from p. 40)

4. c) Students should use 26 pattern blocks for a trapezoid, a trapezoid, a trapezoid, a hexagon, and a hexagon, repeated.

5. a) For example,

b) For example, I started with a triangle, a square, and a triangle. I repeated the 3 shapes.

Lesson 3A Answers (from p. 49)

4. a)

Stem	Leaves for paper-clip chains
16	2
15	1
14	8 9
13	4 7
12	0 6
11	5 9
10	1 4
9	6
8	4

Stem	Leaves for elastic chains
12	0 2 3
11	0 4 8 9
10	0 5 5 8
9	2
8	3 9

b) For example, the data for paper-clip chains are more spread out. This shows that the speeds at which people made paper-clip chains were more varied than for elastic chains.

c) The paper-clip chain is faster to make. More paper clips than elastics were used in the same amount of time.

5. a) Sarah's class

Stem	Leaves for paper clips
3	0 0 0
2	0 1 2 4 4 4 6 6 9 9 9
1	6 6 8 9

Jon's class

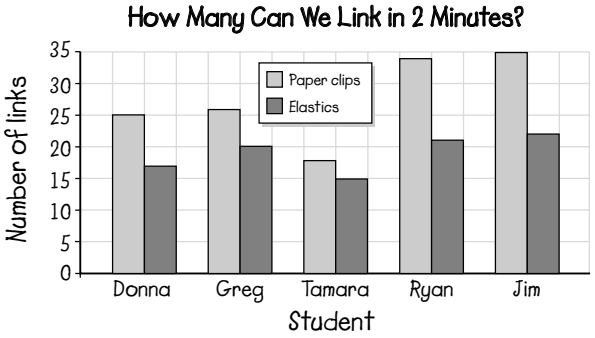
Stem	Leaves for paper clips
3	0 1 2 4 5 6 6
2	1 4 5 5 7 8 8 8
1	8 9 9

b) For example, both stem-and-leaf plots have more leaves for the middle stem, 20, than for the other stems. This shows that most of the data are fairly close to the middle stem. Also, there are 18 students in each class.

c) For example, many of Jon's class's chains were longer than Sarah's class's chains.

Lesson 3B Answers (from p. 52)

5. b) For example,



c) For example, paper clips; the bar for paper clips for my name, Donna, is higher than the bar for elastics.

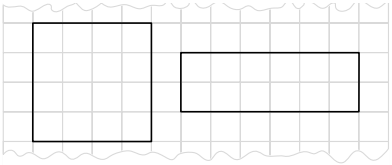
d) For example, Tamara; the heights of the bars for Tamara are closer together than the bars for anyone else.

Lesson 5A Answers (from p. 63)

5. a) pentagon, triangle **b)** For example, about 120 cm

c) quadrilateral: 115 mm; pentagon: 83 mm; triangle: 83 mm

6. For example,



7. a) centimetre; For example, the sides of a cell phone are too long to measure in millimetres and too short to use decimetres.

b) millimetre; For example, the sides of a calculator key are too short to measure in centimetres.

c) kilometre; For example, a province is too large to measure in metres.

d) metre; For example, the sides of a backyard are too short to measure in kilometres, but too long to measure in decimetres.